ENERGY AUDITS/ENERGY
ENGINEERING ANALYSIS PROGRAM

SILAS B. HAYS ARMY COMMUNITY HOSPITAL
FORT ORD, CALIFORNIA

FINAL REPORT

EXECUTIVE SUMMARY

PREPARED FOR:

U.S. Army Engineer District, Sacramento
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1.0 INTRODUCTION

This document is the Executive Summary of the Energy Audits/Energy Engineering Analysis Program for the Silas B. Hays Army Community Hospital prepared under Contract No. DACA05-84-C-0069 between the department of the Army (Sacramento District), Corps of Engineers, and Chilton Engineering, Chartered. This project has been executed as a part of the Department of the Army's Energy Engineering Analysis Program (EEAP). The overall objective of the project is to develop a systematic plan of projects that will result in the reduction of the energy consumption in compliance with the objectives set forth in the Army Facilities Energy Plan (AFEP), without decreasing the readiness posture of the Army.

The criteria utilized in performing this EEAP study is the Scope of Work (SOW) dated 1 November 1982, revised 28 December 1983, which includes the Detailed Scope of Work for Silas B. Hays Army Community Hospital. The complete Scope of Work is provided in Appendix C of this document. All energy conservation opportunities considered will be included in one of two categories, ECIP Projects, or Non-ECIP Projects.

The governing criteria for ECIP projects and for performing economic analyses is the "Energy Conservation Investment Program (ECIP) Guidance", DAEN-MPO-U, 6 August 1982, revised 31 December 1982 and 18 January 1983. The construction cost of ECIP projects must be greater than $200,000. It is assumed that all improvement projects will be awarded in FY1988 (midpoint of construction in January of FY1989, BOD in July of FY1989). The Uniform Present Worth (UPW) discount factors utilized in the Savings to Investment Ratio (SIR) life cycle cost economic analysis are taken directly from Table 9 of the ECIP Guidance. Table 9 UPW discount factors are based upon a 7% discount rate and DOE projected fuel escalation rates for Region 9 which includes Fort Ord, California. The maximum possible economic life for all ECIP projects is 15 years.

This Executive Summary and all of the Programming Documents that result from this study fully comply with the criteria and guidance documents described above. As per the Site Specific Scope of Work, the Programming Documents generated by this EEAP include DD Form 1391, Life Cycle Cost Analysis Summary Sheet and the Project Development Brochure, PDBI, for ECIP Projects.

The study methodology for the EEAP at Silas B. Hays Army Community Hospital is segmented into three phases of work. Phase I involves data gathering and field surveys. Phase II includes analysis of the data collected during the initial phase, identification of potential projects, feasibility and economic evaluations, and preparation of support data for DD Forms 1391. The procedure for identification of potential projects includes use of Annex A of the SOW, "Energy Conservation Opportunities". The final segment of the study methodology Phase III, includes completion of the DD Forms 1391, and preparation of the final report document which presents the results, and recommendations of this study.

The Executive Summary specifically addresses results pertaining to the completion of all phases of the study. The Final Report consists of all of the data developed throughout the study, as well as all energy savings project developments and recommendations. The Final Report volume titles are delineated below for which this Executive Summary applies:

Volume I : Main Report
Volume II : Appendices
Volume III: Programming Documents
Volume IV : Air Flow Measurement Study
Volume V : Field Survey Data

The Air Measurement Study is a separately bound volume which presents the detailed air flow measurements conducted for the hospital. Lastly, the Field Survey Data presents all raw data collected during the study. This volume is transmitted to the facility only.

A brief description of the hospital facilities is presented in Section 2 of this Executive Summary. Section 3 discusses the energy profile of the hospital, including current energy use and current energy expenses. Section 4 presents a summary of the Energy Conservation Opportunities (ECO's) developed as a result of the EEAP. The packaged energy conservation projects analyzed and the economic feasibility results of these projects are reviewed. Section 5 presents the results of the abbreviated metering plan for the hospital. ECO's for three dental clinics also addressed within the study are identified in Section 6. The energy plan which addresses the projects implementation strategy and the effects on future hospital energy consumption is presented in Section 7.

The Executive Appendix of this document includes, for the reader's convenience, a complete glossary of terms and abbreviations in Appendix A, a Reference list in Appendix B, and the Scope of Work in Appendix C. Throughout this document, literature references are denoted by a reference number in brackets (e.g. [1]). These numbers correspond to the references located in Appendix B.

2.0 FACILITY DESCRIPTION

Silas B. Hays Army Community Hospital is located within the Fort Ord Army Post about one-hundred (100) miles south of San Francisco Bay. The facility is bordered by the Pacific waters of Monterey Bay and extends nine (9) miles inland. Figure 2.1.1 shows the Fort Ord proximity to Monterey and Santa Cruz. The maritime climate results in year round mild temperatures with a winter average of 51°F, and a summer average of 61°F.

The 366,959 square foot, eight story hospital was completed in 1971. The building is constructed primarily of concrete, with single pane setback windows. There are two types of doors, glass and steel. In FY1983 there were 48,984 clinic patients in the 400 bed facility. The average bed occupancy was 130 beds in FY1983.

A number of mechanical systems serve the hospital. The primary energy conversion equipment is housed in the boiler plant. This includes two steam boilers, two steam-to-hot water heat exchangers, two reciprocating chiller systems, energy transfer fluid circulating equipment, and an emergency power generating system.

The entire hospital is conditioned by twelve dual duct air handling systems with zone mixing boxes. There is no return air capability. All systems except one operate year round with no night set back control capability. There are nineteen exhaust air systems with each serving a different area of the hospital.

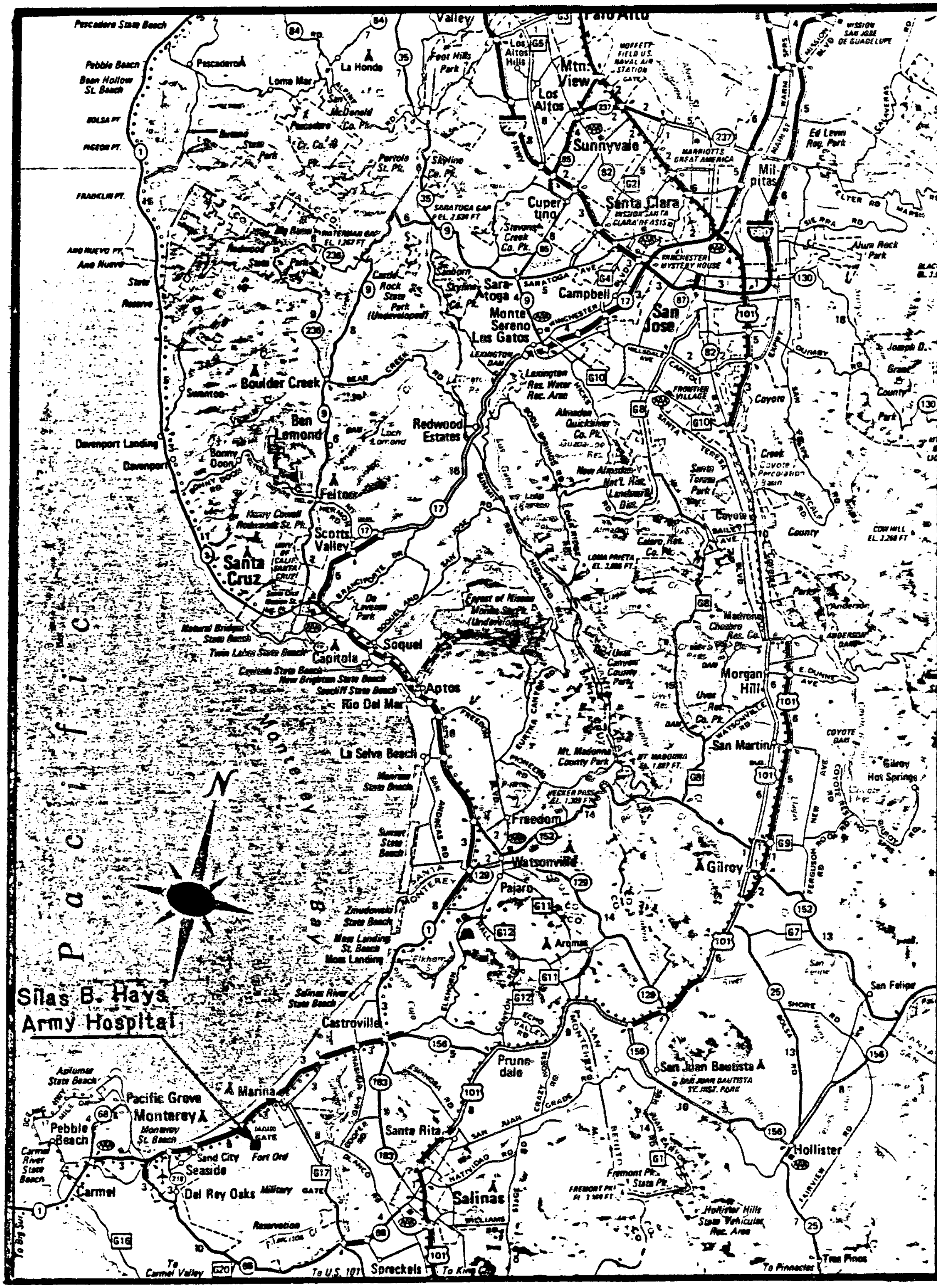
Perimeter areas of the top five floors of the hospital are not served by the supply air systems. Heating for these areas is provided by a baseboard convection system and ventilation is controlled by operable windows. Only the toilet areas are mechanically exhausted.

The cooling capability at the hospital is minimal, serving one major air handler and the two critical area air handlers (surgery and OB/nursery), plus three small areas. Due to strict requirements governing interior air conditions within the computer facility and the excessive cooling loads generated, a cooling system serving only this area was installed. Excessive amounts of heat are produced also when the emergency electrical generating system is activated, so this area is also supplied with cooling. The third area with cooling equipment is the nuclear medicine treatment room, due to strict requirements and equipment generated heat.

Domestic hot water is generated inside three separate water tanks located in the boiler plant, using steam-to-hot water heat exchangers. Water for lavatory sinks, showers, and service sinks is about 112°F, while the the kitchen hot water is approximately 142°F.

The interior and exterior lighting system of Silas B. Hays Army Community Hospital utilize three types of lamps: fluorescent, incandescent and mercury vapor. The fluorescent lamps are the most common throughout the hospital. They are virtually all thirty-five watt (35W) energy savers. Incandescent lamps vary from forty watts (40W) to 150 watts. The mercury vapor lamps (250W and 1,000W) are used for exterior lighting.

FIGURE 2.1.1 MONTEREY BAY AREA



The major energy consuming equipment within the hospital other than lighting and mechanical systems include both electricity and natural gas consumers. Electricity consuming equipment includes medical and kitchen equipment, the elevator system, and the computer equipment. Natural gas is consumed directly by the kitchen equipment such as ovens and grills, and indirectly by steam equipment such as sterilizers.

The hospital is currently connected to the Fort Ord Energy Monitoring and control System (EMCS). The existing EMCS has no control functions at the hospital and only monitors the status of the hospitals' HVAC systems and certain equipment.

3.0 ENERGY CONSUMPTION

The present energy consumption is rigoursly derived using a DOE 2.1A Building Energy Analysis Computer program. Since no separate hospital metering exists, historical energy consumption is unavailable. The building is simulated by describing all envelope, mechanical, and electrical components utilizing the detailed building data developed during the field investigation.

Table 3.1.1 presents the energy balance summary for the hospital which delineates the components of building energy consumption. The total calculated energy consumption for Silas B. Hays Army Community Hospital is 163,453.5 MBtu/Yr which corresponds to an Energy Utilization Index (EUI) of 482.2 KBtu/SqFt/Yr. This total source[a] consumption includes 67,948.1 MBtu/Yr (679,481 Therms) of natural gas and 95,505.4 MBtu/Yr (8,233,577 kWh site) of electricity. The energy balance summary is depicted graphically in Figure 3.1.1 which shows both source and site energy consumption delineated by end-use component. Figure 3.1.2 shows the source EUI's for each component.

Based upon current natural gas and electricity energy rates and the above calculated energy consumption, the annual energy expenditures are developed. Annual natural gas expenses average $433,237 while annual electricity expenses average $523,191, which combines to a total annual energy cost of $956,428.

a) 1 kWh = 3.413 kBtu (site electricity) = 11.6 kBtu (source electricity). Site electricity represents the equivalent Btu's consumed at the comsumption site. Source electricity is the equivalent fossil fuel Btu's required to produce the electricity consumed and includes generation and distribution efficiencies.

TABLE 3.1.1

ENERGY BALANCE SUMMARY

CATEGORY OF USE	SITE ENERGY ELECTRICITY (MBTU)	SITE ENERGY NATURAL GAS (MBTU)	SOURCE ENERGY ELECTRICITY (MBTU)	SOURCE ENERGY NATURAL GAS (MBTU)
Space Heating	939.6	63,502.7	3,193.5	63,502.7
Space Cooling	661.0	0.0	2,246.6	0.0
HVAC Auxilliary	14,623.0	0.0	49,700.2	0.0
Domestic Hot Water	52.2	4,188.4	177.4	4,188.4
Lighting	6,377.8	0.0	21,676.7	0.0
Elevators	450.5	0.0	1,527.0	0.0
Misc. Equipment	4,997.1	257.0	16,984.0	257.0
TOTAL	28,101.2	67,948.1	95,505.4	67,948.1
COSTS			$523,191	$433,237
TOTAL SITE ENERGY		96,049.3 MBTU	283.3 KBTU/SQFT[a]	
TOTAL SOURCE ENERGY		163,453.5 MBTU	482.2 KBTU/SQFT[a]	
TOTAL COST			$956,428	

a Based upon a conditioned floor area of 339,000 square feet.

ANNUAL ENERGY CONSUMPTION

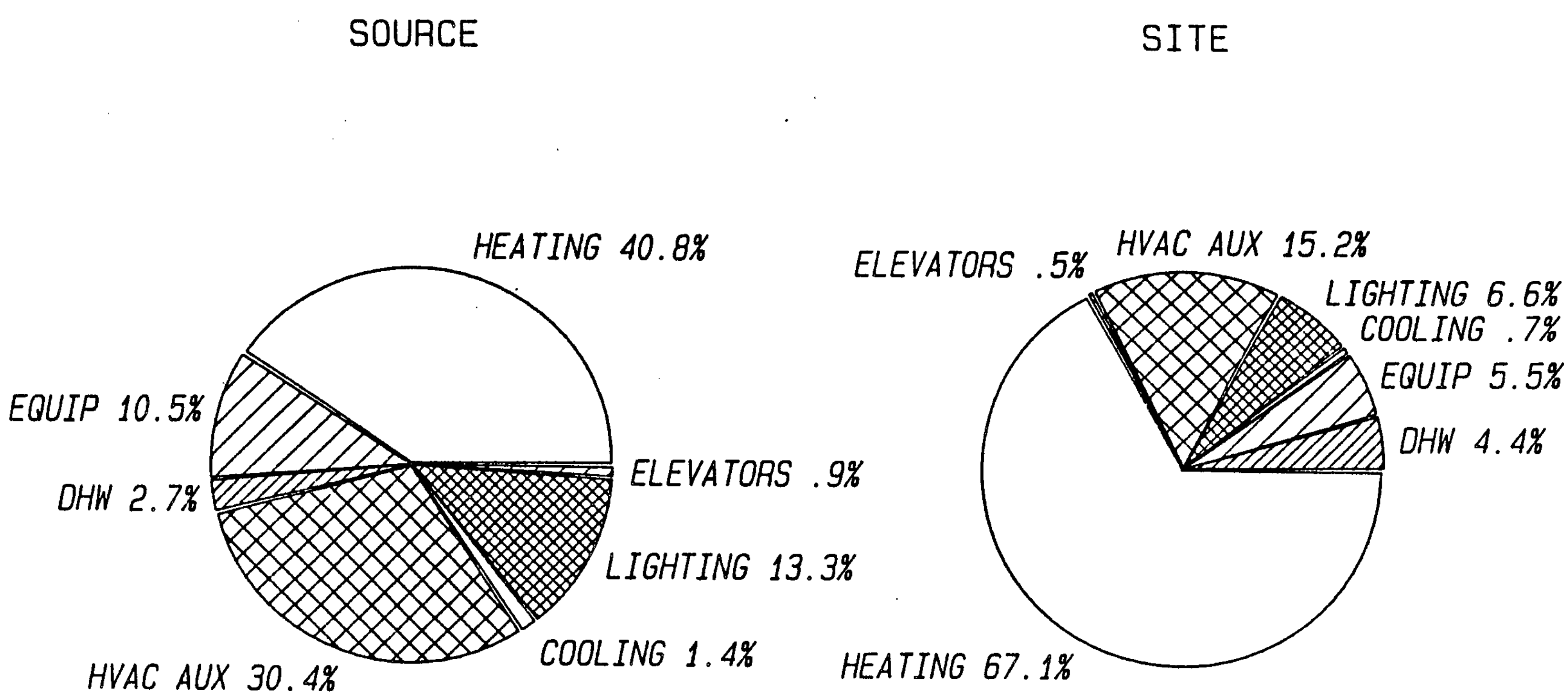


FIGURE 3.1.1

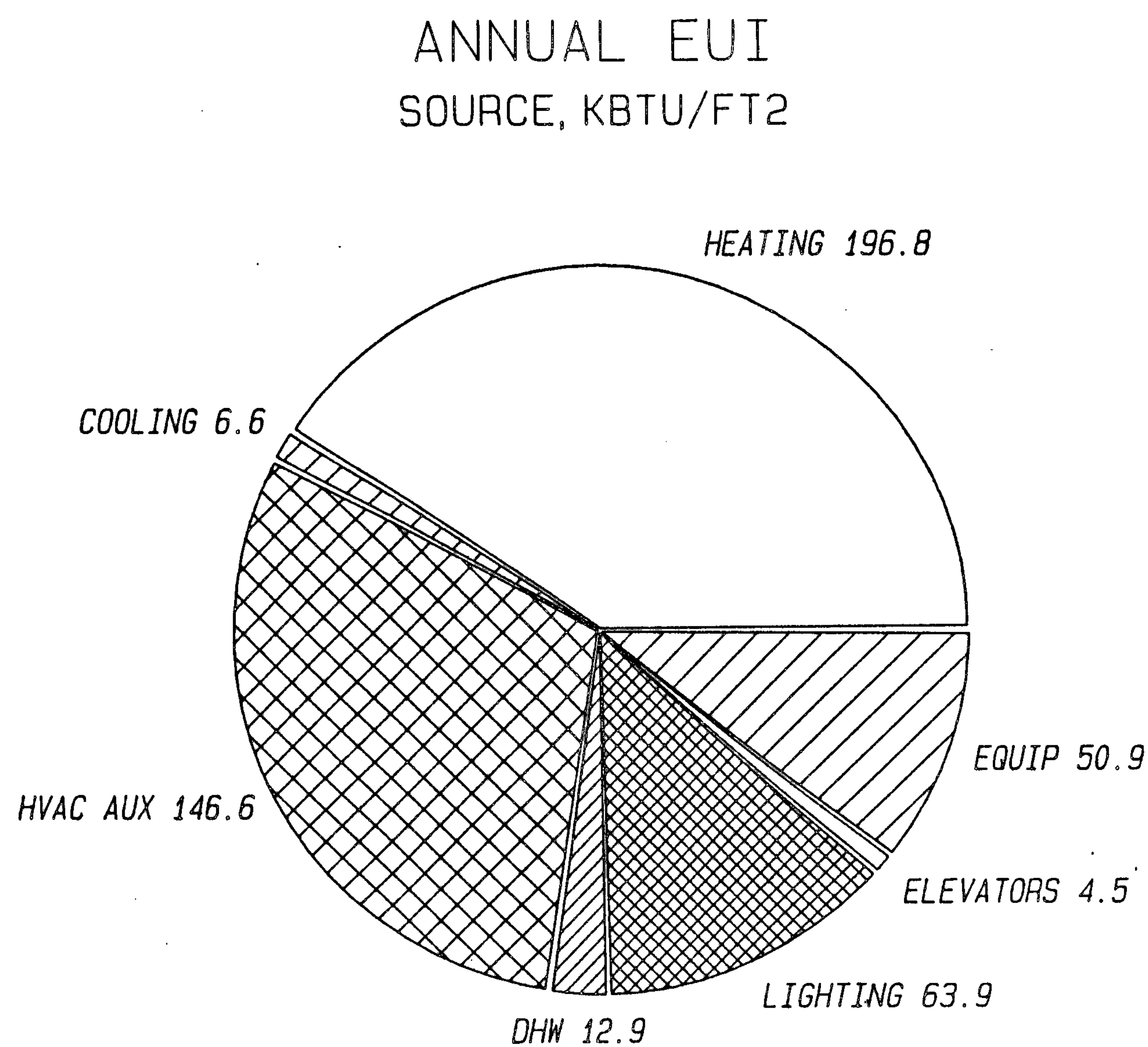

ANNUAL EUI
SOURCE, KBTU/FT2
HEATING 196.8
COOLING 6.6
HVAC AUX 146.6
DHW 12.9
LIGHTING 63.9
ELEVATORS 4.5
EQUIP 50.9

FIGURE 3.1.2

4.0 ENERGY CONSERVATION ANALYSES

The ECO's developed within this EEAP study are categorized and described. Utilizing the implementation cost and economic feasibility results, ECO's or combinations of ECO's are categorized into the project funding categories described in Section 4.1. Project packaging is accomplished in conjunction with DEH and hospital personnel. Sections 4.2 through 4.10 describe the projects and technical results identified for funding under each category.

4.1 Project Categorization

Energy Conservation Opportunities (ECO's) are categorized into eight (8) project types for the purpose of complying with objectives set forth in the scope of the Energy Engineering Analysis Program (EEAP). The classification of ECO's enables identification of the projects which should be implemented through facility funds, through the Energy Conservation Investment Program (ECIP), through other non-ECIP funding programs (QRIP, OSD PIF, PECIP) or do not apply to any funding means. These categories are defined below.

- General Recommendations. General recommendations apply to the entire facility representing ECO's essential to a continuing maintenance program for attaining and maintaining efficient energy use. These measures involve operation and maintenance procedures in which the quantification of energy savings is impossible to define. These recommendations are to be implemented by facility personnel on a continuing basis.

- Non-ECIP Projects

  - No Cost/Low Cost ECO's. These ECO's are characterized by requiring minimal or no capital investment, a quick return on any investment required, and immediate implementation by the facility engineer and hospital personnel. No Cost/Low Cost ECO's are synonymous with operation, maintenance, and repair type projects.

  - Quick Return on Investment Program (QRIP). This program is for ECO's which have a total cost not over $100,000 and will amortize in two (2) years or less.

  - OSD Productivity Investment Funding (OSD PIF). This program is for ECO's having a total cost greater than $100,000 and an amortization period of less than four (4) years.

  - Productivity Enhancing Capital Investment Program (PECIP). This program is for ECO's having a total cost of more than $3,000 and an amortization period of less than four (4) years.

- ECIP Projects. ECO's or combinations of ECO's which qualify for ECIP funding must comply with the investment, energy savings, and economic feasibility criteria outlined in the Energy Conservation Investment Program, governed by the ECIP Guidance, dated 10 August 1982 and revised 18 January, 1983. ECIP projects require a capital investment

of greater than $200,000 and must exhibit a Savings-to-Investment Ratio (SIR) greater than one.

- Projects Requiring Further Investigation. These projects are potentially viable ECO's which cannot be satisfactorily treated within the scope of this contract. They require further study and analysis in order to determine capital investment, energy savings, and economic feasibility. Upon future analysis of these potential projects they can be classified into one of the other categories outlined herein.

- Non-Feasible ECO's. All ECO's which are considered but are not feasible. Feasibility is determined based on practical reasons, economics (SIR less than one).

- Non-Applicable ECO's. ECO's which are not applicable are for systems which do not exist or in which the system already incorporates the ECO.

The hospital and DEH staff were consulted to determine how projects should be categorized. The following categorization of projects desired by the staff is shown.

4.2 General Recommendations

The degree of effectiveness associated with a facility energy conservation program cannot be totally predicted. In addition to the ECO's which have direct and identifiable impacts are measures who's effects cannot be projected. The implementation of these ECO's is, however, vital to the program's success. These measures are generally directed towards deficiencies in operation and maintenance procedures. Where deficiencies have persisted over a long period of time, costly corrective actions are recommended as an initial step towards routine servicing.

Section 4.2 is a discussion of such ECO's that are recommended for the hospital. The implementation and continued compliance of these recommendations is a vital component in achieving projected energy reductions.

Paramont to equipment repair, however, is the correction of operation and maintence procedure deficiencies. The deficiencies at Silas B. Hays Army Community Hospital are attributable to two shortfalls in the system.

- The maintenance staff, through lack of expertise and/or knowledge, is not conducting a thorough preventative maintenance program. Consequently, various system components are presently operating inefficiently.

- The offsite maintenance management departments are too far removed from the day-to-day maintenance activities to effectively coordinate an efficient program. Furthermore, the segregation of maintenance tasks between different management departments reduces the program's effectiveness. As a result, a well managed, thorough preventive maintenance program does not exist. The maintenance program must be coordinated on-site through a single department. Only then will enough control exist to assure staff compliance.

4.2.1 Air Balance HVAC Distribution System

This section addresses the present operating conditions of the HVAC air distribution systems. An analysis is presented which concentrates on the systems' ability to meet current space conditioning requirements as per ETL 1110-3-344, "Interior Medical Design Conditions for Medical Facilities," 4 October 1983 [18]. Recommendations are made for system modifications necessary to meet those requirements. After careful evaluation of the hospital's air distribution systems, several operational deficiencies are evident. Modifications for correcting the problem areas are discussed in this section.

Paramount to any major system modifications, restructuring the hospital's operational and maintenance procedures is in order. Presently, every supply and exhaust fan system is operating below 1973 levels as a result of poor maintenance. A routine coil, fan blade, and register cleaning schedule must be immediately developed and implemented. The schedule should assure that every preheat, hot deck and cold deck coil, and fan unit be cleaned annually. In addition, all supply and exhaust air registers must be regularly serviced.

After the initial cleaning of the systems, the air capacity of each supply and exhaust fan will be increased to near 1973 levels. At this time, the air delivery rate of each system must be measured. The results of the measurements are to be compared to the current standards. If a system is delivering more air flow than required, the motor can be downsized to achieve further energy savings.

This entire procedure is recommended for implementation prior to any other system modifications. It may be found that the motors of every system can be downsized, and at that time smaller high efficiency motors can be installed. As a result, the energy savings associated with replacing all of the existing fan motors with high efficiency models would greatly exceed the projections stated for the ECO to "Install High Efficiency Fan Motors".

Once the fan systems air delivery rates have been corrected, a building wide air balance will be required. The air balance contractor will be responsible for adjusting the supply air quantities so that each space complies with current standards. In addition, he will assure that the exhaust rates are providing the proper pressurization.

The air balance contractor can not do his job effectively if the air distribution systems controls are not functioning properly. Therefore, prior to air balancing, a building wide service check and claibration of the control system will be required.

During the field investigation it was noted that an excessive amount of oil had leaked into the control side of the pneumatic system. Past experience has shown that this condition will eventually cause the control units to fail. The oil forms a scale which will flake off and become entrapped within the control unit. As a result the internal workings of the unit will either become blocked or damaged. Blockage can be blown free, but if the unit is damaged, it must be replaced.

The entire pnumatic system must be serviced. The procedure requires that the system be charged with freon. Then each terminal point of the system must be opened to atmosphere and blown out for a short period of time.

Had the system been properly maintained, the problem would never have occurred. Therefore, to prevent this problem in the future, it is vital that an efficient preventive maintenance program be instituted.

To increase the longivity of the compressor, thus reducing the likelihood of oil entering the system, the unit's operating environment must be improved. It is recommended that outside air be routed to the compressor inlet. This can be accomplished by a duct running from the outside of the boiler room's north wall.

All conditions evaluated indicate that after proper servicing and calibration, the existing fan systems shall be capable of providing interior comfort levels within required standards. Recommendations made here should first be implemented before any additional fan system modifications intended to correct air flow deficiencies are contracted.

4.2.2 Other Recommendations

The following presents a summary of ECO's for which the quantification of energy savings is impossible to define. It is recommended, however, that these actions be taken. The implementation of these measures is crucial to attaining and maintaining the projected energy savings identified throughout this document. These recommendations apply to the entire facility as a continuing maintenance program for energy management.

4.2.2.1 Regular Service/Calibrate HVAC Mechanical Equipment

This recommendation addresses all HVAC preventative maintenance procedures generally scheduled for implementation quarterly. Included are filter replacement, diffuser cleaning, proper system operation verification and controls calibration, and coil cleaning.

In order to maintain the proper operating condition, setpoints, and energy efficiency, all HVAC control systems must be kept in calibration. For example, deck reset controls, mixing box controls, and temperature control panel receiver-controllers are in need of calibration. In several cases, it was noted that mixing box dampers would not move to the full ventilation position. There was also wide space temperature variation throughout the hospital, which also indicates calibration problems.

With an efficient calibration program implemented, unnecessary energy consumption and costs can be avoided. For example, if the controller for the preheat coil setpoint was out of calibration for supply System 6, with an OSA flow of 31,270 cfm, it could be preheating unnecessarily. When the outside air is 50°F, there should be no preheating, yet if the controller is out of calibration and set at 55°F instead, there would be an unnecessary usage. Assuming the system is predominately in the cooling mode, a savings of 170.4 MBtu/Hr of heating energy could be realized with proper calibration. This equates to an annual energy cost avoidance of $1,530/Yr. Estimating calibration to take an hour yields an implementation cost of approximately $34.

Many dirty supply and exhaust registers were noted. This is particularly true of the exhaust air registers. Dirt build-up in these registers restricts air flows, thereby reducing system efficiency and comfort. Some of the "stuffy"

space conditions noted could be improved by cleaning these registers. These register conditions may also be contributing to the low air flows noted at the system fans.

An efficient coil cleaning program can not be stressed enough. Dirty coils consume energy in two ways: 1) by increasing the static pressure in the supply air duct, thus, requiring the fan to work harder, and 2) by decreasing the heat transfer rate of the coil resulting in a higher, or lower in the case of cooling, return water temperature thereby increasing the parasitic heat transfer between the return water system and the ambient air. Routine coil cleaning is even more important in coastal areas where the air is laden with salt particles.

4.2.2.2 Repair Leaky Valves and Fittings

Steam leaks in piping and valves or in equipment are an obvious source of waste energy. For example, a one-eighth (1/8) inch diameter hole in a steam line or valve under 100 pounds of pressure would result in a loss of 65 pounds of steam per hour. For natural gas this would correspond to a loss of approximately $5,700/Yr. Assuming it would take about four hours to fix a steam leak, the cost would be $135/leak. Building personnel should investigate for leaks and/or should notify maintenance personnel so repairs may be made.

4.2.2.3 Repair/Replace Faulty EMCS Sensors

To maintain the integrity and operating efficiency of the EMCS monitoring system, measuring sensors must be maintained in accurate operating order. Sensors should be checked annually and calibrated as required. Without proper maintenance, data retrieved through the system is unreliable for performance trend monitoring or performing calculations.

4.2.2.4 Turn Lights Off in Unoccupied Areas

In many hospital areas, lights are left on in unoccupied spaces. This occurs during the day when offices become vacant for periods of time and also occurs after normal working hours. For example, the six dental exam rooms in the northeast corner of the third floor are lit for nine hours, seven days per week. Because these rooms are not used continuously, it is conceivable that the lights could be turned off by the dental staff in each room for approximately half of the time. With each room having four, four lamp fixtures, this would result in an annual energy savings of 6,543.7 kWh/Yr. This would correspond to an annual savings of approximately $472/Yr. In addition, the East and West Wards of the eighth floor were lit, although these areas are currently unused.

4.2.2.5 Develop and Implement a Schedule Lens/Lamp Cleaning Program

Clean lenses and lights ensure increased levels of illumination. Fixtures should be cleansed during lamp replacement and all lamps should be cleaned or inspected for filth yearly. Although no quantifiable energy savings is associated with this measure it is conceivable that lamps could get dirty enough to require additional task lamps. A cleaning crew of two persons should be allowed 1.5 hours per 100 SqFt of lighting. This would correspond to approximately $72 per 100 SqFt of lighting per year to improve overall lighting effectiveness.

4.3 Non-ECIP Projects

4.3.1 No Cost/Low Cost Projects

Section 4.3.1 presents the No Cost/Low Cost ECO's recommended for implementation at Silas B. Hays Army Community Hospital. The measures are characterized by requiring minimal or no capital investment, a quick return on any investment required, and immediate implementation by the facility engineer and hospital personnel.
Five No Cost/Low Cost ECO's are recommended for immediate implementation. The ECO's are structured so that local funding can be appropriated by the facility. The ECO's, as discussed below, recommend modifications in building lighting strategies and envelope configuration.

4.3.1.1 Replace Incandescent with Screw-In Fluorescent

Energy savings are achieved by replacing standard incandescent lamps with small screw-in fluorescent lamp and ballast arrangements which screw directly into the incandescent lamp sockets. These fluorescent lamps require eighty to ninety percent (80% to 90%) less energy to operate at equivalent luminosity levels, depending on the incandescent lamps they replace. The cost of these lamps is greater than that of incandescent lamps, but their average life expectancy is also about fifteen (15) times as great. Therefore, this project recommends replacing incandescent lamps with screw-in fluorescent lamps where appropriate.

All of the incandescent lamps in non-critical areas such as offices, restrooms, and patient rooms should be replaced (567 in non-patient rooms and 652 in patient rooms). The incandescent lamps currently used in these areas range from 60 watt (W) to 100 W with 75 W being the average and most common wattage. However, adequate lighting levels can be met with 60 W incandescent lamps due to the use of the areas of concern. The offices use incandescent lighting in a complimentary manner (e.g. desk lamp) to the main light source. Restroom lighting level requirements are such that the 60 W lamp will satisfactorily meet these levels. Patient room incandescent lighting is similar in use to that of rest room lighting. It is located at sinks and in the toilet room. Again, low lighting level requirements indicate 60 W lamps will adequately meet the necessary level. The luminosity of a 60 W incandescent lamp can be obtained from an 11 W fluorescent lamp. Therefore, these incandescent lamps should be replaced with 11 W fluorescent lamps (eleven watts includes ballast draw).

The energy and dollar savings made possible by these replacements and the implementation costs are analyzed for two groups of incandescent lamps because two distinct lighting schedules exist in the hospital. One group includes all lamps not located in the patient rooms, and the other group includes those located in the patient rooms. In order to implement this project, a capital investment of $40,936 is required. The energy and cost savings are 2,641.8 MBtu/Yr and $15,934/Yr, respectively. A fifteen year net discounted savings of $168,781 will be realized. The resulting SIR is 4.6, and the simple payback is 2.3 years.

4.3.1.2 Lighting System Controls

Lighting system controls can save energy by automatically turning off lights when proper lighting levels are met with daylighting. Interior photocells can be set at illumination levels described in ETL 1110-3-334, Medical and Dental Facility Illumination. When daylighting levels within the space meet or exceed the set levels, the photocell activator switch turns off the electric lights.

This project recommends using photocell controls in two areas of the hospital. Photocells should be used to control lighting in the cafeteria dining area and in the waiting area at the outpatient entrance. A major portion of the east and south facing walls of the dining area are windows allowing ample daylighting for the entire area. The outpatient waiting area is well lit during the middle of the day by a large glass atrium. In both areas, daylighting can meet the lighting demand for a significant portion of the day. The lights should be controlled in sections which are selected by their location relative to daylight penetration. Some rewiring is necessary. Six photocells are needed in the dining area and two are needed in the outpatient waiting area.

The energy savings made possible by these photocell controls are determined for each controlled section and are then summed to give the energy savings for the entire area. The required capital investment for implementation of the project is $4,703. The energy and cost savings are 355.4 MBtu/Yr and $2,820/Yr, respectively. A fifteen year net discounted savings of $28,722 will be realized. The resulting SIR is 6.6, and the simple payback is 1.5 years.

4.3.1.3 Delamp Building Lighting

Energy savings are realized by delamping areas which are in excess of the lighting levels described in Medical and Dental Facility Illumination, ETL 1110-3-334. A reduction in peak demand as well as a reduction in annual energy consumption can be realized through delamping these areas. Therefore, this project recommends delamping many areas of the hospital.

All areas applicable to delamping and the details of lamp removal are described in project backup data. For all hospital areas combined, delamping by 582 lamps and disconnecting 367 ballasts reduces lighting capacity by 31.2 kW. This reduces source annual electrical energy consumption by 1,565.1 MBtu/Yr.

The cost to implement the project is $6,524. The annual cost savings and fifteen year net discounted savings are $10,424 and $108,608, respectively. The resulting SIR is 18.5, and the simple payback is 0.6 years.

Other methods of delamping may be evaluated during project design. As technology changes, new products may become available which will accomplish the same end, such as current limiters and the Pow-R-Shunt system.

4.3.1.4. Replace the Mercury Vapor Lamps in the Parking Areas With High Pressure Sodium

The parking area surrounding the hospital is currently lit by 1,000 W and 250 W mercury vapor lamps. High pressure sodium lamps of 400 W and 100 W can be used to replace these lamps, respectively, without reducing the luminosity below 85%

of the existing lighting. Of the parking area lighting, energy can be saved by reducing the wattage, therefore, this project recommends replacing the mercury vapor lamps and ballasts in the hospital parking area with lower wattage high pressure sodium lamps and ballasts.

A total of 116 lamps should be replaced, 91 of the 1,000 W lamps and 25 of the 250 W lamps. The lower wattage required by the 400 W and 100 W high pressure sodium lamps will reduce source electricity consumption by 3,078.6 MBtu/Yr. This is an annual energy cost savings of $15,116.

The cost to implement the project is $50,084. The annual cost savings and fifteen year net discounted savings are $15,695 and $166,109, respectively. The resulting SIR is 3.7, and the simple payback is 2.9 years.

4.3.1.5 Improve Vestibule Entry

The vestibule located at the outpatient entrance on the first floor is not functioning in a manner which maximizes energy savings. The inner and outer doors currently open simultaneously. This action defeats the purpose of the vestibule by allowing direct interior/exterior air transfer. The vestibule should act as a buffer zone to limit direct infiltration of non-conditioned air or direct exfiltration of conditioned air. Energy can be saved by retrofitting the doors so that they operate independently with only one set of doors open at any given time. Therefore, this project recommends retrofitting the inner and outer doors to operate independently at the first floor outpatient entrance.

The improved vestibule will save 459.6 MBtu/Yr of natural gas. The cost to implement the project is $4,995. The annual cost savings and fifteen year net discounted savings are $2,930 and $35,453, respectively. The resulting SIR is 7.9, and the simple payback is 1.5 years.

4.3.1.6 No Cost/Low Cost ECO Summary

The analysis results for each of the five recommended no cost/low cost ECO's are shown in Table 4.3.1 ranked in order of decreasing SIR. By implementing all five projects, the facility will save 8,100.5 MBtu of source energy per year. The dollar savings realized the first year will be $47,803, and the fifteen year net discounted savings will be $507,673. The cost to implement these projects will be $107,242. The discounted savings to investment ratio for the projects combined is 5.3, and the simple payback is 2.0 years.

4.3.2 Quick Return on Investment Projects (QRIP)

This section presents the QRIP projects recommended for implementation at Silas B. Hays Army Community Hospital. Each project requires an implementation investment of less than $100,000 and amortizes in two (2) years or less.

Two projects fall into the QRIP classification. Implementation of these projects are totally independent of any other project recommended in this study. They are designed to reduce the annual energy consumption associated with the supply and exhaust air distribution systems. The following sections present a discussion of each QRIP project including a description and each project's analysis results.

TABLE 4.3.1

NO COST/LOW COST ECO ECONOMIC ANALYSIS SUMMARY

PROJECT	SOURCE ENERGY SAVINGS (MBTU/YR)	ENERGY TYPE	ANNUAL ENERGY COST SAVINGS ($/YR)	ANNUAL NON-ENERGY SAVINGS ($/YR)	TOTAL ANNUAL DOLLAR SAVINGS ($/YR)	TOTAL COST TO IMPLEMENT ($)	TOTAL NET DISCOUNTED SAVINGS ($)	SAVINGS TO INVESTMENT RATIO (SIR)	SIMPLE PAYBACK (YR)
Delamp Building Lighting	1565.1	E	8,918	1,506	10,424	6,524	108,608	18.5	0.6
Improve Vestibule Entry	459.6	NG	2,930	0	2,930	4,995	35,453	7.9	1.5
Lighting System Controls	355.4	E	1,982	838	2,820	4,703	28,722	6.6	1.5
Replace Incandescent With Screw-In Fluore-scent	2641.8	E	15,439	495	15,934	40,936	168,781	4.6	2.3
Replace the Mercury Vapor Lamps in the Parking Areas With High Pressure Sodium	3078.6	E	15,116	579	15,695	50,084	166,109	3.7	2.9
TOTALS	8100.5	NA	44,385	3,418	47,803	107,242	507,673	5.3	2.0

4.3.2.1 Revise Hot Deck Reset Schedule

It is recommended that the current hot deck reset schedule be modified. The new schedule calls for deactivating the heating coils when ambient temperatures rise to 70°F and above. Presently the schedule calls for maintaining the air temperature at 85°F when ambient temperatures range between 70°F and 85°F. The high end of the reset schedule is to remain the same such that for ambient conditions at or below 35°F, the hot duct supply air is maintained at 100°F.

Since the reset control proportionally adjusts the hot duct air temperature between the two set points, energy savings will be realized not only when ambient conditions are above 70°F, but also within the 35°F to 70°F range. For example, presently when ambient conditions are 50°F the hot deck is set to maintain an air temperature of 94°F. The new schedule will result in an air temperature of 87°F. Energy savings arise from reduced heat losses to unconditioned spaces through duct air leakage.

Replacement of the existing reset controls will require a capital investment of $3,623. On an annual basis, the project will reduce energy consumption and costs 605.9 MBtu/Yr and $3,786/Yr, respectively.

The Life Cycle Cost Analysis (LCCA) shows that a fifteen year net discounted savings of $45,247 will be realized. In relation to the project cost, this discounted savings produces an SIR of 13.9. The project's simple payback is 0.9 years.

4.3.2.2 Improve HVAC Capacity Control

This project recommends that selected air distribution systems be equipped with controls enabling shut down of space conditioning in unoccupied areas. Presently, the entire hospital is maintained at occupant comfort levels twenty-four hours per day. Energy savings will be realized in two ways: 1) reductions in space heating loads, and 2) decreases in fan motor operation.

Six areas of the hospital have occupancy schedules which provide the opportunity for space conditioning shut down. The areas include the dietary services area, the EENT clinic, the Neuropsychiatric and Orthopedic clinics, the Physical Examination and OB/GYN clinic, the north half of the General Practice clinic, and the Respiratory Disease Investigation area, Preventative Medicine area, and Urology and Minor Surgery clinics.

Because of the existing air distribution systems configuration, other areas of the hospital which have regularly unoccupied periods can not be shut down. This condition occurs when a single supply air duct simultaneously serves occupied and unoccupied areas. As a result, the hardware required to provide shut down would cost an exhorbitant amount of capital thus rendering the project infeasible.

Capacity control of the fan systems is provided in two manners: 1) Complete system shutdown, and 2) partial system shutdown. Complete system shutdown is accomplished by a timeclock which deactivates the fans during unoccupied times. Partial systems shutdown is provided by shutting off the air flow with duct dampers to unoccupied areas and simultaneously reducing the fan's speed.

TABLE 4.3.2

QRIP PROJECTS SUMMARY

QRIP PROJECT	PROJECT COST ($)	ANNUAL EFFECTS				15-YEAR DISCOUNTED SAVINGS ($)	SIR	SIMPLE PAYBACK (YR)
		ENERGY SAVINGS (MBTU/YR)	ENERGY COST SAVINGS ($/YR)	COST INCREASES ($/YR)	NET COST SAVINGS ($/YR)			
Provide HVAC Capacity Control	94,658	18,431.4	105,492	1,300	104,192	1,190,197	14.0	0.8
Revise Hot Deck Reset Schedule	3,623	605.9	3,786	0	3,786	45,247	13.9	1.0
TOTALS	98,281	19,037.3	109,278	1,300	107,978	1,235,444	14.0	0.8

The QRIP project to Improve HVAC Capacity Control will require a capital investment of $94,658 for implementation. The project will reduce annual energy consumption and costs 18,431.4 MBtu/Yr and $105,492/Yr, respectively. Annual costs to maintain the new system will be $1,300/Yr. In fifteen years, the net accumulated discounted savings will be $1,190,197. The resultant SIR is 14.0 and the simple payback is 0.8 years.

4.3.2.3 QRIP Projects Summary

After implementation of the two QRIP projects, substantial decreases in annual energy consumption and costs will be realized. Table 4.3.2 presents the results of both projects ranked in order of decreasing SIR. In addition, Table 4.3.2 presents the total impacts once both projects are implemented. For a total cost of $98,281 an annual dollar savings of $107,978 is achievable producing an SIR of 14.0 and a simple payback of 0.8 years.

4.3.3 OSD Productivity Investment Funding (OSD PIF)

No ECO's recommended for implementation at Silas B. Hays Army Community Hospital are categorized as OSD PIF.

4.3.4 Productivity Enhancing Capital Investment Program (PECIP)

Potential PECIP projects are presented for Silas B. Hays Army Community Hospital. Each project requires an implementation cost of greater than $3,000 and amortizes in four (4) years or less. Note that two EMCS options are presented as potential PECIP projects. Only one would be implemented, not both.

4.3.4.1 Energy Monitoring and Control System (EMCS)

Two EMCS implementation options are considered for Silas B. Hays Army Community Hospital. The options are as follows:

- Option 1: Provide a completely independent EMCS for the hospital to monitor and control mechanical and electrical systems in the hospital with remote monitoring at the installation's existing EMCS location.

- Option 2: Expand the existing installation EMCS to monitor and control mechanical and electrical systems at the hospital, with the control function located at the hospital only.

Since both options exhibit feasible economics, both are presented here as potential PECIP projects. Both options meet PECIP criteria by having an investment requirement in excess of $3,000 and having a simple payback of less than four (4) years. Note also that the system expansion option exhibits a cost of greater than $200,000 making it a possible ECIP candidate, as well. However, Option 1 is the recommended option.

4.3.4.1.1 EMCS Option 1 - Independent System

The installation of an independent EMCS for the hospital to monitor and control mechanical and electrical systems is recommended. Remote monitoring is provided at the installation's existing EMCS control room, while control functions are located at the hospital engineering office only.

The EMCS provides a central point of operator monitoring and control of certain hospital HVAC systems. This enables the implementation of certain energy conservation program applications in order to effect energy savings in the controlled systems.

The installation of the independent EMCS will require a capital investment of $180,733. On an annual basis, the project will reduce energy consumption by 19,671.1 MBtu/Yr which corresponds to a net cost savings, including increased maintenance costs, of $94,139 per year.

The LCCA shows that a fifteen year net discounted savings of $1,177,097 will be realized. Utilizing this discounted savings in conjunction with the implementation cost, the project shows an SIR of 7.2. The simple payback is 1.9 years.

4.3.4.1.2 EMCS Option 2 - System Expansion

The expansion of the existing post EMCS to monitor and control hospital mechanical and electrical systems is also investigated. Although, this EMCS option is not recommended for implementation, the project does show feasible economics (SIR is greater than one (1.0)). The description and results are provided for comparison so that facility personnel may decide on the best option to suit their needs. As with the independent system, control functions are provided only at the hospital engineering office, while monitoring is still provided at the post EMCS control room. The expansion of the existing EMCS provides similar control capabilities as the independent system in an effort to conserve energy.

The expansion of the existing EMCS will require a capital investment of $229,271. On an annual basis, the project will reduce energy consumption by 19,764.9 MBtu/Yr which corresponds to a net cost savings, including increased maintenance costs, of $71,745 per year.

The LCCA shows that a fifteen year net discounted savings of $974,875 will be realized. Utilizing this discounted savings in conjunction with the implementation cost the project shows on SIR of 4.7. The simple payback is 3.2 years.

The installation of the independent EMCS is recommended in favor of the expansion of the existing system. The independent EMCS shows much better economics, shows a significantly lower installation cost, and will be much less costly to maintain. Additionally, a new state-of-the-art EMCS would be much more user friendly, faster, and would be much easier to expand and change than the existing system. Table 4.3.3 presents the analysis results of both options.

TABLE 4.3.3

ECONOMIC COMPARISON OF EMCS OPTIONS

EMCS OPTION	IMPLEMENTATION COST ($)	ANNUAL ENERGY SAVINGS (MBTU/YR)	NET ANNUAL DOLLAR SAVINGS ($/YR)	SIR	SIMPLE PAYBACK (YRS)
OPTION 1:					
Independent EMCS	180,773	19,671.1	94,139	7.24	1.9
OPTION 2:					
Existing EMCS Expansion	229,271	19,764.9	71,745	4.72	3.2

4.4 Energy Conservation Investment Program (ECIP)

This section presents the ECO or group of ECO's that are classified as ECIP projects. To qualify as an ECIP project the ECO's total capital investment must exceed $200,000 and the project must exhibit a Savings-to-Investment Ratio (SIR) greater than one.

Two ECIP projects are recommended for implementation at Silas B. Hays Army Community Hospital. The two ECIP projects are each packaged in accordance with DEH and hospital staff directives. One project, Reduce Outside Air Loads, is made up of a single ECO. The second project, HVAC Modification, combines five ECO's all of which qualify as feasible ECO's when evaluated on their own.

The following sections present a discussion of each ECIP project. Included is a description of the project, a summary of its impact on energy consumption, and its Life Cycle Cost Analysis (LCCA).

4.4.1 Reduce Outside Air Loads

Presently the hospital is serviced by an HVAC system which utilizes 100% Outside Air (OSA). As a result, instead of recirculating tempered interior air, the system exhausts all air to the outside. Consequently, a significant amount of additional energy is required to condition the outside air due to the much larger volume of outside air present in the hospital systems when compared to a system that recirculates air. In essence, the additional energy requirements are equal to the amount of energy contained in the air (referenced to ambient temperature) which under normal system operation would be recirculated. The equivalence being based on the energy associated with the temperature difference between the OSA and exhaust air.

Two methods of reducing the energy waste are available: 1) providing return air capability, or 2) mechanically transferring the heat energy from the exhaust air to the supply air. The first method is infeasible due to existing system constraints. Each individual exhaust air system services contaminated and non-contaminated areas of the hospital. Consequently, none of the air can be recirculated. Therefore, this ECIP project recommends employing method two.

It is recommended that heat transfer coils be installed within selected supply and exhaust air systems. The coils shall be connected by a thermal fluid piping network through which heat reclaimed from the exhaust air can be transferred to the supply air. Heat normally rejected to the atmosphere can then be used to temper the OSA prior to pre-heating within the supply air system. The new system will decrease annual natural gas energy consumption through a reduction in pre-heating requirements. The system is designed to operate only when the OSA temperature is below 50°F. For temperatures above this level, existing controls call for the pre-heat coil to be deactivated. Therefore, any reclaimed heat added to the supply air stream may cause an unnecessary overheating condition within the space. This project applies to eight supply and thirteen exhaust air systems.

The ECIP project to Reduce Outside Air Loads will require a capital investment of $212,410 for implementation. Upon completion of the project, annual energy consumption and costs will be reduced 4,225.4 MBtu/Yr and $27,067/Yr, respectively. As a result of the new equipment, annual maintenance costs will increase $3,351. The project shows a fifteen year net discounted savings of $298,228. This equates to a Savings-to-Investment Ratio (SIR) of 1.6. The entire project displays a simple payback of 8.1 years.

4.4.2 HVAC Modification

This ECIP project combines five separate ECO's into a single package. Each ECO shows an SIR greater than one and is highly recommended for implementation.

The following sections present a discussion of each ECO included in ECIP project HVAC Modification.

4.4.2.1 Install a Boiler Oxygen Trim System

It is recommended that a control system be installed on the two boilers that will maintain a constant level of oxygen in the exhaust gases. By maintaining

the oxygen level at 2%, the resultant combustion efficiency will be maintained at 84.2%. Presently, the exhaust oxygen level is 12%. This results in a combustion efficiency of 77.9%.

After implementation of the oxygen trim system, annual energy consumption and costs will be reduced 2,028.5 MBtu/Yr and $12,934/Yr, respectively. The modification will require a one time capital investment of $30,250. An annual maintenance cost of $253 will be incurred to maintain the system. The ECO shows a fifteen year net discounted savings of $154,195. This equates to an SIR of 5.6. The simple payback is 2.4 years.

4.4.2.2 Install A Small Auxiliary Boiler

This ECO recommends that a third, smaller boiler be installed at the hospital. The new boiler shall be sized to carry the hospital's steam requirements during reduced space heating conditions.

Analysis shows that the existing boilers operate at or below 20% capacity 6,000 hours per year. As a result, their average operating efficiency is greatly reduced. By providing a 10 MBtu/Hr boiler to handle reduced loads, the 26 MBtu/Hr boilers can function as standbys for 5,832 Hr/Yr. With the small boiler sized to meet the reduced loads, its average operating efficiency will be significantly higher than that of the large boilers.

After installation of the small boiler, annual energy consumption and costs will be reduced 12,214.0 MBtu/Yr and $77,878/Yr, respectively. The modification will require a one time capital investment of $130,618. Annual maintenance costs will increase $624. The ECO shows a fifteen year net discounted savings of $936,639. The resultant SIR is 8.0 and the simple payback is 1.5 years.

4.4.2.3 Provide Surgery Fan Capacity Control

It is recommended that during unoccupied periods, supply and exhaust air quantities in surgery be reduced. Supply air quantities shall be reduced 40% at the same time exhaust air quantities are proportionally reduced to maintain positive pressure within the space. In achieving the air quantity reduction, the operating speed of both the supply and exhaust fans will be automatically reduced. The fans capacity will decrease proportionally to the speed reduction.

After providing capacity control to the surgery fans, annual energy consumption and costs will be reduced 3,503.7 MBtu/Yr and $20,702/Yr, respectively. The modification will require a one time capital investment of $35,908. Annual maintenance costs will increase $177. The ECO shows a fifteen year net discounted savings of $234,409. The resultant SIR is 7.3 and the simple payback is 1.6 years.

4.4.2.4 Install High Efficiency Fan Motors

It is recommended that all of the standard fan motors be replaced with high efficiency motors. This ECO applies to all supply and exhaust fan systems excluding E-17. E-17 utilizes a fractional horsepower motor for which high efficiency models are not produced.

Today, high efficiency motors operate at efficiencies 10.8% to 3.7% higher than standard motors within the size range of three to one-hundred horsepower, respectively. Substantial annual energy savings result when motors replaced operate twenty-four hours per day, as they do in the hospital.

Once the existing motors have been replaced with identically sized, high efficiency motors, annual energy consumption and costs will be reduced 1,645.1 MBtu/Yr and $9,020/Yr, respectively. The modification will require a one time capital investment of $27,577. Annual maintenance costs will not be affected. The ECO shows a fifteen year net discounted savings of $95,973. The resultant SIR is 3.9 and the simple payback is 2.8 years.

4.4.2.5 Provide Kitchen Exhaust Air Heat Recovery

It is recommended that a heat recovery system be installed within the food services area HVAC system. The system is virtually identical to the heat recovery system discussed in Section 4.4.1. However, this system links only one exhaust fan with one supply fan.

Presently, the supply fan introduces 100% outside air with no return air capability. The exhaust system removes air from the dining area in addition to the food preparation area and equipment hoods. Consequently, the air is contaminated and can not be returned to the space. Therefore, a closed loop heat recovery system is the only available means of reducing the heating energy requirements of the system.

The system will require regular cleaning of the heat recovery coil in the exhaust duct which is located on the roof above the kitchen. Annual maintenance costs are $606 and include pump maintenance, glycol replacement, and coil cleaning.

After implementation of the kitchen heat recovery system, annual energy consumption and costs will be reduced 1,011.4 MBtu/Yr and $6,490/Yr, respectively. The modification will require a one time capital investment of $28,996. Annual maintenance costs will increase $606. The ECO shows a fifteen year net discounted savings of $75,359. The resultant SIR is 2.9 and the simple payback is 4.4 years.

4.4.2.6 Total Project Results

The ECIP project, HVAC Modification, combines the five ECO's discussed above. Upon implementation of the entire ECIP project, significant reductions in annual energy consumption and costs shall be realized. Table 4.4.1 summarizes the results of each ECO ranked in order of decreasing SIR, in addition to the entire

ECIP project. At a combined implementation cost of $253,349, the entire project results in a reduction in annual energy consumption of 20,402.7 MBtu/Yr. This reduction equates to an annual energy cost savings of $127,024/Yr. In maintaining the new equipment associated with the project, annual maintenance costs will increase $1,836.

The LCCA of the project shows that in fifteen years the net discounted savings will amount to $1,496,575. In relation to the total project cost, this net savings results in a Savings to Investment Ratio (SIR) of 6.6. The project's simple payback is 1.8 years.

TABLE 4.4.1

HVAC MODIFICATION ECO SUMMARY

ECO	PROJECT COST ($)	ANNUAL EFFECTS ENERGY SAVINGS (MBTU/YR)	ENERGY COST SAVINGS ($/YR)	COST INCREASES ($/YR)	NET COST SAVINGS ($/YR)	15-YEAR DISCOUNTED SAVINGS ($)	SIR	SIMPLE PAYBACK (YR)
Install A Small Auxiliary Boiler	130,618	12,214.0	77,878	624	77,254	936,639	8.0	1.5
Provide Surgery Fan Capacity Control	35,908	3,503.7	20,702	177	20,525	234,409	7.3	1.6
Install Boiler Oxygen Trim System	30,250	2,028.5	12,934	253	12,681	154,195	5.6	2.4
Install High Efficiency Fan Motors	25,577	1,645.1	9,020	0	9,020	95,973	3.9	2.8
Provide Kitchen Exhaust Air Heat Recovery	28,996	1,011.4	6,490	606	5,884	75,359	2.9	4.4
TOTALS	253,349	20,402.7	127,024	1,660	125,364	1,496,575	6.6	1.8

4.4.3 ECIP Projects Summary

After implementation of the two ECIP projects, substantial decreases in annual energy consumption will be realized. Table 4.4.2 summarizes the results of both ECIP projects ranked in order of decreasing SIR. For a total implementation cost of $465,759 annual cost savings of $149,080 is realized with an SIR of 4.3 and a simple payback of 2.8 years.

Table 4.4.3 presents a summary of all ECO's recommended.

4.5 ECO's Requiring Further Investigation

Section 4.5 lists projects identified during this study that are recommended for analysis under a separate contract. The projects are not analyzed in this report since the complexity of their analysis is beyond the contracted scope of work.

The following ECO's have historically displayed favorable economics. A hospital facility like Silas B. Hays Army Community Hospital is an ideal situation for their application.

- Cogeneration - Since the hospital requires high pressure steam generation for process loads year round, cogeneration is a viable source for realizing electricity consumption reductions. In addition, a cogeneration application would allow the existing boilers to operate near full capacity year round. Under these conditions, combustion efficiencies are at an optimum level thus reducing the energy consumption associated with the process loads.

- Refuse Conversion - The normal daily operations of a hospital facility and surrounding Fort Ord post produce exhorbitant amounts of refuse. Highly efficient and clean burning incinerator/boiler combinations are manufacturered today which provide an economical source of heat energy. Annual cost savings are realized in both energy consumption reductions and refuse hauling costs.

It may be worthwhile analyzing the above two projects in combination, a refuse burning boiler cogeneration system.

4.6 Non-Feasible ECO's

Several possible ECO's proved to be nonfeasible after evaluation. They are not recommended for implementation due to economic disqualification or because of impractical application. The following is a discussion of each nonfeasible ECO.

4.6.1 Variable Air Volume (VAV) Retrofit

After careful evaluation and extensive research, the possibility of retrofitting the existing dual duct HVAC system to a variable air volume (VAV) system is deemed infeasible. Upon comparing the existing systems operational characteristics to that of the energy efficient VAV system, the infeasible ruling can be concluded empirically based upon the discussion presented below.

The dual duct to VAV retrofit is a very popular energy conserving modification in hospitals today. However, the economics associated with the conversion are directly related to the degree of cooling required within the facility. As

TABLE 4.4.2

ECIP PROJECT SUMMARY

ECIP PROJECT	PROJECT COST ($)	ANNUAL EFFECTS ENERGY SAVINGS (MBTU/YR)	ANNUAL EFFECTS ENERGY COST SAVINGS ($/YR)	ANNUAL EFFECTS COST INCREASES ($/YR)	ANNUAL EFFECTS NET COST SAVINGS ($/YR)	15-YEAR DISCOUNTED SAVINGS ($)	SIR	SIMPLE PAYBACK (YR)
HVAC Modification	253,349	20,402.7	127,024	1,836	125,364	1,496,575	6.6	1.8
Reduce Outside Air Loads	212,410	4,225.4	27,067	3,351	23,716	298,228	1.6	8.1
TOTALS	465,759	24,628.1	154,091	5,187	149,080	1,794,803	4.3	2.8

TABLE 4.4.3

RECOMMENDED ECO'S SUMMARY

PROJECT	IMPLEMENTATION COST ($)	ANNUAL ENERGY SAVINGS (MBTU/YR)	ANNUAL DOLLAR SAVINGS ($/YR)	SIR	SIMPLE PAYBACK (YR)	TYPE OF ENERGY SAVED	ECO CLASSIFICATION	IMPLEMENTATION YEAR
Delamp Building Lighting	6,524	1,565.1	10,424	18.5	0.6	Elec.	No Cost/Low Cost	1986
Improve HVAC Capacity Control	94,658	18,431.4	104,192	14.0	0.8	Elec./N.G.	QRIP	1986
Revise Hot Deck Reset Schedule	3,623	605.9	3,786	13.9	0.9	Elec./N.G.	QRIP	1986
Install a Smaller Auxiliary Boiler	130,618	12,214.0	77,254	8.0	1.5	N.G.	ECIP[a]	1989
Improve Vestibule Entries	4,995	459.6	2,930	7.9	1.5	N.G.	No Cost/Low Cost	1986
Provide Surgery Fan Capacity Control	35,908	3,503.7	20,525	7.3	1.6	Elec./N.G.	ECIP[a]	1989
EMCS Stand Alone	180,773	19,671.1	94,139	7.2	1.7	Elec./N.G.	PECIP	1986
Lighting System Controls	4,703	355.4	2,820	6.6	1.5	Elec.	No Cost/Low Cost	1986
Install a Boiler Oxygen Trim System	30,250	2,028.5	12,681	5.6	2.4	N.G	ECIP[a]	1989
Replace Incandescent With Screw-In Fluorescent Lights	40,936	2,641.8	15,934	4.6	2.3	Elec.	No Cost/Low Cost	1986
Install High Efficiency Fan Motors	27,577	1,645.1	9,020	3.9	2.8	Elec.	ECIP[a]	1989
Replace the Mercury Vapor Lamps in Parking Lot with High Pressure Sodium Lamps	50,084	3,078.6	15,695	3.7	2.9	Elec.	No Cost/Low Cost	1986
Provide Kitchen Exhaust Air Heat Recovery	28,996	1,011.4	5,884	2.9	4.4	Elec./N.G.	ECIP[a]	1989
Reduce Outside Air Loads	212,410	4,225.4	23,716	1.6	8.1	Elec./N.G.	ECIP[b]	1989

a One of five ECO's included in ECIP project - HVAC Modification.
b Single ECIP project.

internal cooling loads increase, so does the impact on associated energy savings. Consequently, in mild climatic areas, like the Fort Ord area where cooling requirements are low, energy savings associated with a dual duct to VAV retrofit are not as attractive as in more severe climatic areas.

As stated above, the VAV system is best suited in buildings that primarily require cooling. The system is designed to provide maximum air delivery on a demand for cooling. Air flows modulate to minimum levels then the space no longer requires conditioning and remains at that level during the heating mode. Because of these operational characteristics, the VAV system has gained the reputation of being energy efficient. However, in the case of retrofitting the dual duct system at Silas B. Hays Army Community Hospital, the VAV will in fact increase energy consumption.

Presently, only twenty percent (20%) of the hospital's floor space is mechanically cooled by three of the nine dual duct systems. The remaining six systems rely on ventilation air to handle the cooling load. Furthermore, the constant volume systems are presently delivering sufficient amounts of air to meet the minimum air change standards. Consequently, a VAV system for the hospital is not a suitable modification. First, mechanical cooling is not required throughout a majority of the hospital. Second, the minimum air delivery rate of a VAV system would, by requirements, match that of the existing system. Consequently, no energy savings are achievable through reductions in air flow with the VAV. Conversely with the VAV system, during a call for cooling, the air quantity delivered to the space will increase above levels presently supplied. Thus, resulting in an energy consumption increase due to additional fan loading.

Additionally, the existing exhaust system layout is not conducive to automatic variable air removal between zones. In many cases a single exhaust system services more than one supply system area. The VAV system requires that exhaust/return air quantities be controlled in proportion to supply air quantities to assure proper pressurization of the zone. Due to the existing exhaust system's layout, this mode of control is not possible without extensive reducting.

In conclusion, from a practical and energy conserving standpoint, modifying the hospital's existing dual duct HVAC system to function as a VAV system is infeasible. As a result of the mild climates experienced in the Fort Ord area, the existing systems air delivery rate, and the exhaust systems configuration the economics associated with a VAV retrofit do not justify the modification.

4.6.2 Infectious Waste Incinerator Heat Recovery

Heat recovery from the infectious waste incinerator is infeasible due to the low volume of waste. The hospital generates about 80 pounds per day of infectious waste. Heat reclaim equipment manufacturers estimate that a minimum of 300 pounds per hour of waste are required to economically justify an incinerator heat recovery system.

4.6.3 Kitchen Heat Recovery From Waste Hot Water

Heat recovery from steam kettle condensate and dishwasher rinse water were considered, but were rejected for several reasons. There is no end use for the recovered energy in the kitchen and using the energy to preheat hot water would require piping it to the hot water tanks in the boiler room. Piping costs and heat loss would be too high for an economic return when one considers that the waste hot water is available only sporadically and in small volumes.

4.6.4 Install Photocell on Exterior Lighting System

This ECO was considered, but rejected when it was determined that a photocell activator for the parking lot lighting would actually increase the number of hours the lights are on. The lights are currently activated by a timer switch. The switch is reset periodically throughout the year by maintenance personnel. The lights are currently on an average of 11.4 hours/day. Assuming a photocell would turn the lights off at sunrise and on at sunset, the average hours per day the lights would be on using this system is 11.8 hours/day on an annual basis. This would result in a net increase of operational hours of 0.4 hours/day should this ECO be implemented.

4.6.5 Replace Standard Fluorescent Ballasts with New, More Efficient Standard Fluorescent Ballasts.

Standard ballasts being manufactured today are more energy efficient than the ballasts installed at the time of construction. The new standard ballasts operate at a thirteen (13) to fifteen (15) percent decreased wattage draw (two (2) to two and a half (2½) watts decrease). The analysis considers only standard ballasts for replacement. This is due primarily to the unreliability of the energy efficient ballasts available (refer to articles in Volume II, Appendix F3.7). As technology improves and high efficiency ballasts are time tested for reliability, options to consider are electronic (solid state) and high efficiency electromagnetic ballasts. The relatively low energy reduction achieved with the new standard ballasts is not enough to overcome installation costs within the fifteen year qualifying period. Calculations for a single fixture resulted in an installation cost of $51 and an annual savings of $1.50/Yr, which translates to a 30.4 year payback. However, it is recommended that these new ballasts be phased in as the old ballasts burn out. In this way, no added installation costs are incurred.

4.6.6 Improve Vestibule Entries - Main Entrance

The vestibules located at the main entrance on the second floor are not functioning in a manner which maximizes energy savings. The inner and outer doors currently open simultaneously. In order to maximize the energy savings potential of these vestibules, the doors must operate independently with one door open at any given time. Due to building orientation and door traffic, the infiltration and exfiltration rates at the main entrance are considerably lower than the rates at the oupatient entrance. Less energy is lost, so the potential energy savings are much less. This ECO is infeasible due to the low energy savings achievable at this entrance.

4.6.7 Provide Return Air Capabilities

This ECO was considered but rejected for two reasons. Primarily, the physical layout of the systems is prohibitive to recirculation modifications. The majority of the exhaust fans are located on the roof of the penthouse while the majority of the supply fans are located in the second floor mechanical room. Extensive recirculation ducting would be required from exhaust to supply. Secondly, in the systems where physical layout is advantageous for recirculation modifications, a single exhaust may have both clean and contaminated air. It is impossible to segregate the two air qualities and the air, therefore, is nonreturnable.

4.6.8 Combustion Air Preheat

Preheating Combustion Air for the main boilers was considered but rejected because the auxiliary boiler installation would reduce main boiler operation below 200 hours per year. This operations period is too short to generate a economic return on the investment.

4.7 Non-Applicable Energy Conservation Opportunities (ECO's)

HEATING VENTILATING AND AIR CONDITIONING

- Shut off room fan coils - Room fan coils do not exist at Silas B. Hays Community Hospital.
- Shut off stairwell heating - The stairwells are not presently heated.
- Shut off circulating pumps - The perimeter baseboard heating systems' pump is presently deactivated during warm ambient conditions. The air handlers heating coil pump must operate twenty-four hours per day due to the diversity of loads throughout the hospital. Chilled water pumps are presently staged in response to the cooling load.
- Reduce humidification to a mimimum - This ECO has already been performed.
- Reduce pumping flows - Existing pumping flows are sized to meet design loads. Where applicable, pump flow is varied to match load.
- Reset thermostats - The thermostats are already reset.
- Repair and maintain steam lines and steam traps. Maintenance program is presently practiced.
- Use outside air for free cooling - Existing systems presently employ free cooling.
- Reduce re-heating of cooled air - Re-heating is not presently utilized.
- Reduce chilled water circulating during light loads. The pumps are currently staged with respect to load.

- Replace hand valves with automatic controls - A changeover program for the perimeter baseboard heating system is presently in effect.

- Common headering of chillers - This presently exists at the hospital.

<u>BOILER PLANT</u>

- Reduce steam distribution pressure - Due to the hospital's present steam usage, steam pressure can not be reduced.

- Shut off steam to laundry - A laundry facility does not exist at the hospital.

- Repair, replace, or install condensate return system - A condensate return system presently exists and is in good operating condition.

- Insulate boiler and piping - Existing insulation is in satisfactory condition.

- Install economizer - This measure is not applicable to the supply system which employs 100% OSA.

- Install air pre-heater - Entering air temperature to boiler is presently 90°F.

- Check boiler water chemistry program - Program is presently practiced daily.

- Clean boiler tubes - Tubes are cleaned semi-annually.

- Automatic blow-down control - Manual blow-down is conducted under efficient supervision.

- Condenser/cooling tower treatment - Systems are automatically treated.

- Install storm windows - Storm windows are not appropriate for the Fort Ord climate.

- Install roof insulation - This ECO is not applicable for the climate at Fort Ord.

<u>BUILDING ENVELOPE</u>

- Reduce infiltration by caulking and weatherstripping - Caulking and weatherstripping throughout hospital is adequate and in good condition.

- Install loading dock seals - Loading docks are non-existent at the hospital.

- Reduce window heat gain - The ECO is not applicable for the Fort Ord climate.

ELECTRICAL EQUIPMENT

- Shut off elevators when possible. This measure is not applicable to twenty-four hour operation.

- Shut off pneumatic tube system when possible. A pneumatic tube system does not presently exist.

- Install capacitors to increase power factor. This ECO has been previously addressed in Electrical, Mechanical, and Safety Systems Upgrade, Buonaccorsi & Associates [17].

- Shed electrical loads - Previously addressed in Electrical, Mechanical, and Safety Systems Upgrade, Buonaccorsi & Associates [17].

- Balance loads - Electrical loads are balanced.

- Reduce transformer losses by proper loading and balancing - Transformers are experiencing minimal losses.

PLUMBING

- Reduce DHW temperatures - DHW setpoints are already at a minimum for this type of facility.

- Repair hot water and steam pipe insulation - existing insulation is in satisfactory condition.

- Install flow restrictors - Shower flow restrictors are not recommended in the hospital.

- Install automatic shut off faucets - This ECO is not appropriate for the hospital.

- Decentralize hot water heating - The boilers are required year round for the steam processes.

- Pipe insulation - Pipe insulation is present and in good condition.

LAUNDRY

- Install heat reclamation systems for laundry wash water, dryers - No laundry presently exists at the hospital.

KITCHEN

- Shut off range hood exhaust when possible - This is the current practice at Silas B. Hays Army Community Hospital.

- Shut off equipment and appliances when possible. This ECO is presently in operation.

- Install make-up air supply for exhaust - Due to physical restraints this modification is infeasible. However, an air-to-water heat recovery system is recommended.

5.0 METERING PLAN

Silas B. Hays Army Community Hospital currently has one natural gas meter and no electric service meters. The natural gas meter is located in the primary gas pipeline serving the building. In recent years, gas meter readings by facility personnel were discontinued, but will be reinstated in the near future.

No electric meters currently exist which serve the hospital exclusively. Consequently, the annual electricity usage and building electrical demand levels are unknown quantities. Since this hospital represents the largest single energy consumer at the Fort Ord Post, the installation of an electric meter in the primary 12 kV service would be very beneficial. Several alternatives exist for accomplishing the metering including permanent and temporary metering.

1. Install permanent metering with current and voltage brought out to a test block. Cost estimates by local contractors are $25,000 an $23,500.

2. Perform power recordings on the low voltage side of the four substation power transformers off the 12 kV circuit for a one week period and also for one month duration. Recordings shall consist of the following:

   - Kilowatt-hours (kWh)
   - Daily peak demand (4 separate intervals per day) (kW)
   - Power factor of the load

The estimated costs to install, monitor, and remove these meters was provided by the local electrical contractors and are listed below.

Metering Period	Estimated Cost
One Week	$5,800 - $6,300
One Month	$6,800 - $7,400

Included in these estimates is the contractor's cost to visit the meters every other day to check the meters and perform any service required.

3. Purchase a portable electric power/demand analyzer which can be utilized by facility electrical maintenance personnel. A portable meter would enable metering at each hospital substation or any other electrical panel in the building for any desired length of time. This meter can be purchased with associated clamps and cables for approximately $3,600. Including meter installation and meter readings the cost would be $6,576.00.

Based upon these cost estimates the protable electric power/demand analyzer is recommended. This option provides the greatest versatility and the lowest cost. The use of such a meter would not only aid the hospital in monitoring its current energy consumption, but would also provide tracking of energy conservation progress. If this meter was purchased and installed soon, it could provide a baseline electricity consumption to track progress on future energy conservation projects.

Submetering Feasibility

In analyzing the power requirements of different use areas throughout the hospital it is observed that there are no single areas of high energy use. Rather, the hospital as a whole has a high, and fairly constant energy usage. For this primary reason there is no beneficial purpose to submetering.

6.0 DENTAL CLINIC ECO's

An energy survey of the Fort Ord Dental Clinics Buildings 3599 and 3700 and the Presidio of Monterey Medical - Dental Clinic Building 422 was conducted, consisting of a visual inspection to identify ECO's. This aspect of the study involves only identification of ECO's for these buildings. No energy analysis and economic analyses are required as per the Detailed Scope of Work (Appendix C). The following measures were identified:

Building 3599:

- Calibrate all controls, tune and regularly test boiler, balance air distribution system
- Reset conditioning time clock "off hour" from 6:00 p.m. to 4:30 p.m.
- Install locking covers on thermostats
- Adjust thermostats to 68°F for heating and 75°F for cooling
- Revise hot deck schedule to lower temperature at higher outside temperatures
- Reduce domestic hot water (DHW) temperature to 105°F
- Install chilled water reset temperature controls
- Install a time clock to shut off DHW circulation pump during non-operational hours.

Building 3700:

- Calibrate all controls, tune boiler
- Clean air filters in air handler
- Lower interior thermostat settings to 68°F
- Repair locking thermostat covers
- Reduce DHW to 105°F
- Delamp corridor lighting
- Install time clock to shut off heating during non-operational hours
- Install a time clock to shut off DHW circulation pump during non-operational hours

Building 422:

- Calibrate/adjust all controls
- Provide seasonal thermostat adjustment, 68°F for heating, 75°F for cooling
- Eliminate exterior lighting during the day
- Reset time clock to have an "off hour" so equipment shuts off during unoccupied hours
- Clean air handler outside air intake screen
- Close supply air registers in limited use areas
- Reduce DHW temperature to 105°F
- Close doors and windows when HVAC system is operating
- Install hot and cold deck temperature reset controls
- Install a time clock to shut off DHW circulation pump during non-operational hours.

These measures are suggested for study but have not been analyzed.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Section 7 summarizes the results of the EA/EEAP study conducted on Silas B. Hays Army Community Hospital. The impact on annual energy consumption associated with each ECO recommended for implementation is presented. Recommendations are ranked in order of the Savings-to-Investment Ratio (SIR) for each ECO as a stand alone project and for the packaged programmed projects.

Section 7 concludes with a discussion of the proposed implementation plans. Two scenarios are developed. This first, Implementation Plan I, includes all feasible ECO's developed within this study excluding the EMCS. Implementation Plan II incorporates all feasible ECO's including the EMCS.

7.1 Summary of Recommended ECO's

Section 7.1 presents a summary of the ECO's discussed in Section 4.0. Each opportunity is shown as a stand alone project for the purpose of comparison.

Table 7.1.1 lists each ECO in order of decreasing Savings-to-Investment Ratio (SIR). The ECO's implementation cost, annual energy savings, associated annual dollar savings, SIR, simple payback, project classification, and implementation years are included.

Review of Table 7.1.1 shows that each ECO qualifies on its own merit as a feasible means of reducing the hospital's annual energy consumption. However, the values as shown are not additive since the results for the EMCS ECO include the impacts associated with two other ECO's listed. The ECO's overall effects are discussed in the following sections.

7.2 Implementation Plans

Section 7.2 presents two plan options for implementating the ECO's recommended in this study. Plan I is developed excluding the effects associated with the EMCS ECO. Plan II incorporates all ECO's including the EMCS project.

The presentation of two strategies is required since the EMCS project incorporates the results of two ECO's which under Plan I are recommended as Programmed Projects. Therefore, the results of these projects are modified in Plan II.

7.2.1 Implementation Plan I

Plan I recommends the implementation of five (5) No Cost/Low Cost projects, two (2) QRIP projects, and two (2) ECIP projects. Each ECO included in the three categories is discussed within Section 4.

Table 7.2.1 presents the nine (9) projects recommended for implementation in Plan I. Each recommendation is a single ECO other than the ECIP project HVAC Modification which combines the results of five separate ECO's. Included in Table 7.2.1 are the projects' implementation cost, annual energy savings, annual dollar savings, SIR, and simple payback. It can be seen that upon implementation of the nine (9) projects, annual energy consumption at Silas B. Hays Army

TABLE 7.1.1

RECOMMENDED ECO'S SUMMARY

PROJECT	IMPLEMENTATION COST ($)	ANNUAL ENERGY SAVINGS (MBTU/YR)	ANNUAL DOLLAR SAVINGS ($/YR)	SIR	SIMPLE PAYBACK (YR)	TYPE OF ENERGY SAVED	ECO CLASSIFICATION	IMPLEMENTATION YEAR
Delamp Building Lighting	6,524	1,565.1	10,424	18.5	0.6	Elec.	No Cost/Low Cost	1986
Improve HVAC Capacity Control	94,658	18,431.4	104,192	14.0	0.8	Elec./N.G.	QRIP	1986
Revise Hot Deck Reset Schedule	3,623	605.9	3,786	13.9	0.9	Elec./N.G.	QRIP	1986
Install a Smaller Auxiliary Boiler	130,618	12,214.0	77,254	8.0	1.5	N.G.	ECIP[a]	1989
Improve Vestibule Entries	4,995	459.6	2,930	7.9	1.5	N.G.	No Cost/Low Cost	1986
Provide Surgery Fan Capacity Control	35,908	3,503.7	20,525	7.3	1.6	Elec./N.G.	ECIP[a]	1989
EMCS Stand Alone	180,773	19,671.1	94,139	7.2	1.7	Elec./N.G.	PECIP	1986
Lighting System Controls	4,703	355.4	2,820	6.6	1.5	Elec.	No Cost/Low Cost	1986
Install a Boiler Oxygen Trim System	30,250	2,028.5	12,681	5.6	2.4	N.G	ECIP[a]	1989
Replace Incandescent With Screw-In Fluorescent Lights	40,936	2,641.8	15,934	4.6	2.3	Elec.	No Cost/Low Cost	1986
Install High Efficiency Fan Motors	27,577	1,645.1	9,020	3.9	2.8	Elec.	ECIP[a]	1989
Replace the Mercury Vapor Lamps in Parking Lot with High Pressure Sodium Lamps	50,084	3,078.6	15,695	3.7	2.9	Elec.	No Cost/Low Cost	1986
Provide Kitchen Exhaust Air Heat Recovery	28,996	1,011.4	5,884	2.9	4.4	Elec./N.G.	ECIP[a]	1989
Reduce Outside Air Loads	212,410	4,225.4	23,716	1.6	8.1	Elec./N.G.	ECIP[b]	1989

a One of five ECO's included in ECIP project - HVAC Modification.
b Single ECIP project.

TABLE 7.2.1
PLAN I PROJECTS SUMMARY

PROJECT	IMPLEMENTATION COST ($)	ANNUAL ENERGY SAVINGS (MBTU/YR)	ANNUAL DOLLAR SAVINGS ($/YR)	SIR	SIMPLE PAYBACK (YR)	ECO CLASSIFICATION	IMPLEMENTATION YEAR
Delamp Building Lighting	6,524	1,565.1	10,424	18.5	0.6	No Cost/Low Cost	1986
Improve HVAC Capacity Control	94,658	18,431.4	104,192	14.0	0.8	QRIP	1986
Revise Hot Deck Reset Schedule	3,623	605.9	3,786	13.9	0.9	QRIP	1986
Improve Vestibule Entries	4,995	459.6	2,930	7.9	1.5	No Cost/Low Cost	1986
Lighting System Controls	4,703	355.4	2,820	6.6	1.5	No Cost/Low Cost	1986
HVAC Modification	253,349	20,402.7	125,364	6.6	1.8	ECIP	1989
Replace Incandescent With Screw-In Fluorescent Lights	40,936	2,641.8	15,934	4.6	2.3	No Cost/Low Cost	1986
Replace the Mercury Vapor Lamps in Parking Lot with High Pressure Sodium Lamps	50,084	3,078.6	15,695	3.7	2.9	No Cost/Low Cost	1986
Reduce Outside Air Loads	212,410	4,225.4	23,716	1.6	8.1	ECIP	1989
TOTALS	671,282	51,765.9	304,861	5.9	2.2	N/A	N/A

Community Hospital will be reduced 51,765.9 MBtu/Yr (31.7% of current consumption). As a result of the $671,282 implementation cost, a reduction in annual costs of $304,861 will be realized. Implementation Plan I shows an SIR of 5.9 and a simple payback of 2.2 years.

The results in Table 7.2.1 are shown graphically in Figure 7.2.1. The impacts on current energy consumption of the three (3) project categories No Cost/Low Cost, QRIP, and ECIP, are displayed over at ten (10) year period in relation to their programmed year.

Figure 7.2.1 shows that starting in 1986, the No Cost/Low Cost projects will reduce annual energy consumption 5.0%. In addition, the QRIP projects will further reduce consumption 11.6%. Starting in 1989, the ECIP projects will result in an additional 15.1% reduction of the current annual energy consumption. In 1989 after implementation of all projects recommended in Plan I, current annual energy consumption will be reduced 31.7%. The effect of this energy reduction on hospital energy costs will reduce the current energy expense from $956,428 per year to $675,438 per year. This new energy expense incorporates fuel rate escalation.

7.2.2 Implementation Plan II

Plan II expands Plan I with the addition of the EMCS project. As a result, the results of the QRIP projects in Plan I are affected.

The QRIP project Revise Hot Deck Reset Schedule is totally absorbed into the EMCS project. The control modification associated with this project is very compatible with the EMCS. Therefore, the project's cost and associated savings are combined into the EMCS project. As a result, Plan II does not recommend the Revise Hot Deck Reset Schedule as a QRIP project.

As with the Revise Hot Deck Reset Schedule project, portions of the QRIP project provide HVAC Capacity Control are compatible with the EMCS. The EMCS project is designed to provide system control with a minimum amount of equipment modification. Two (2) fan systems included in the Capacity Control project are recommended for total shutdown during unoccupied periods. Whereas the remainder of the fan systems addressed in the project require major modifications to provide partial shutdown. Since the EMCS can very easily provide the control for total fan system shutdown, that portion of the Capacity Control project is included in the EMCS project. Therefore, the implementation cost and energy savings associated with the two fan systems are extracted from the Capacity Control project and added into the EMCS project. However, even after modifying the Capacity Control project, it still qualifies as a QRIP project and is recommended as such in implementation Plan II.

The five (5) No Cost/Low Cost projects and two (2) ECIP projects recommended in Plan I remain unchanged in Plan II. The one (1) QRIP project included in Plan II results from the modifications of Plan I's QRIP projects provide HVAC Capacity Control as discussed above. Plan II recommends a PECIP project which covers the EMCS project.

Table 7.2.2 presents the nine (9) projects recommended for implementation in Plan II. Eight (8) of the nine (9) projects recommended in Plan I are included

ANNUAL EUI TRENDS

PLAN I

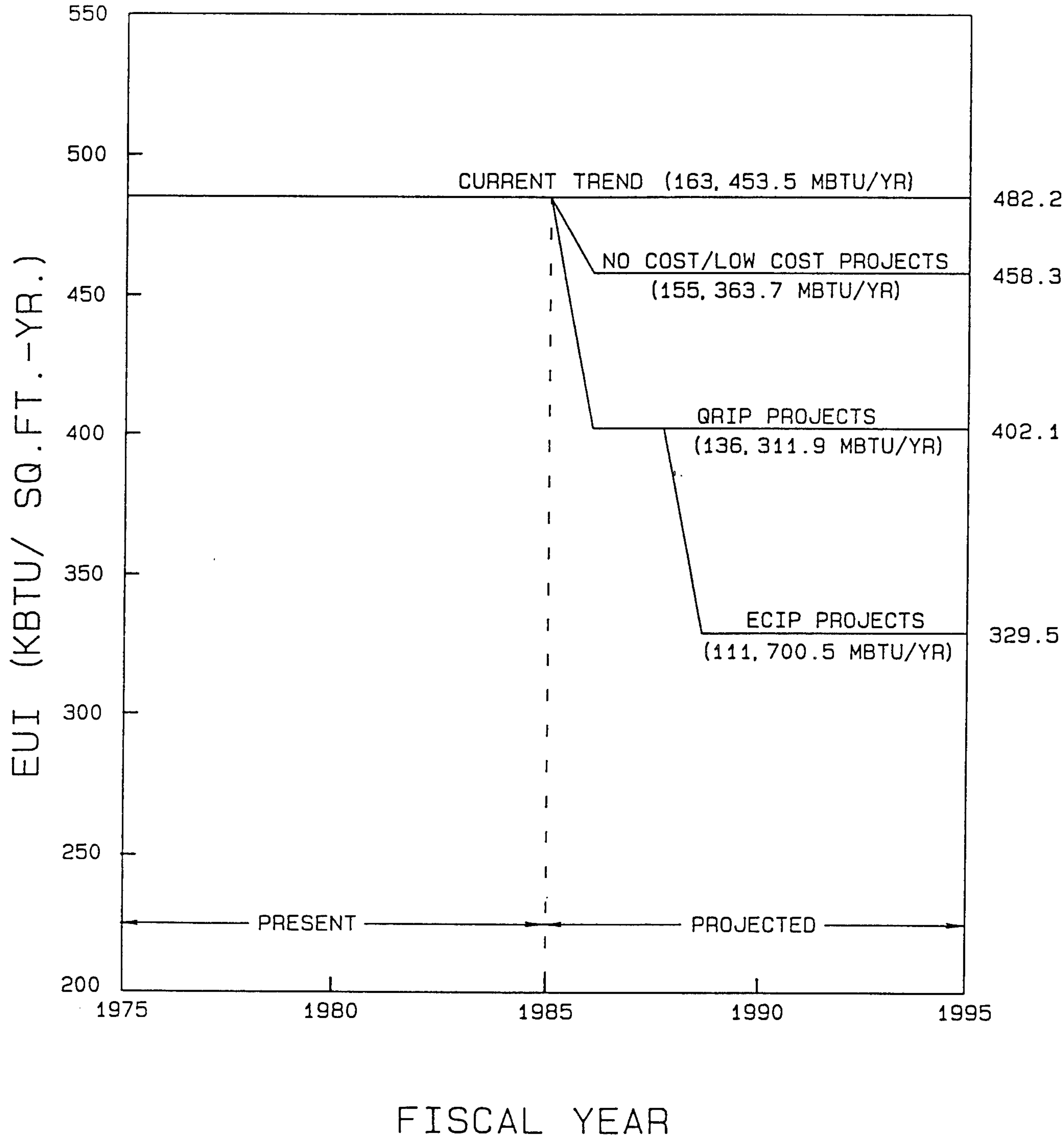


FIGURE 7.2.1

in Plan II with the addition of the Independent EMCS project. The revise Hot Deck Reset Schedule project has been excluded because it is incorporated into the EMCS project. Included in Table 7.2.2 are the projects' implementation cost, annual energy savings, annual dollar savings, SIR, and simple payback. It can be seen that upon implementation of the nine (9) projects in Plan II, annual energy consumption at Silas B. Hays Army Community Hospital will be reduced 64,700.4 MBtu/Yr (39.6% of current consumption). As a result of the $836,550 implementation cost, a reduction in annual costs of $360,174 will be realized. Implementation Plan II shows an SIR of 5.7 and a simple payback of 2.3 years.

The results in Table 7.2.2 are shown graphically in Figure 7.2.2. The impacts on current energy consumption of the four (4) project categories, No Cost/Low Cost, QRIP, PECIP, and ECIP, are displayed over a ten (10) year period.

Figure 7.2.2 shows that starting in 1986, the No Cost/Low Cost projects will reduce annual energy consumption 5.0%. In addition, the QRIP project and PECIP project will further reduce consumption 7.5% and 12.0%, respectively. Starting in 1989, the ECIP projects will additionally reduce current annual energy consumption 15.1%. In 1989 after implementation of all projects recommended in Plan II, current annual energy consumption will be reduced 39.6%. The effect of this energy reduction on hospital energy costs will reduce the current energy expense from $956,428 per year to $589,934 per year. This new energy expense incorporates fuel escalation rates.

TABLE 7.2.2
PLAN II PROJECTS SUMMARY

PROJECT	IMPLEMENTATION COST ($)	ANNUAL ENERGY SAVINGS (MBTU/YR)	ANNUAL DOLLAR SAVINGS ($/YR)	SIR	SIMPLE PAYBACK (YR)	ECO CLASSIFICATION	IMPLEMENT YEAR
Delamp Building Lighting	6,524	1,565.1	10,424	18.5	0.6	No Cost/Low Cost	1986
Improve HVAC Capacity Control	82,776	12,300.7	69,152	10.5	1.1	QRIP	1986
Improve Vestibule Entries	4,995	459.6	2,930	7.9	1.5	No Cost/Low Cost	1986
EMCS Stand Alone	180,773	19,671.1	94,139	7.2	1.7	PECIP	1986
Lighting System Controls	4,703	355.4	2,820	6.6	1.5	No Cost/Low Cost	1986
HVAC Modification	253,349	20,402.7	125,364	6.6	1.8	ECIP	1989
Replace Incandescent With Screw-In Fluorescent Lights	40,936	2,641.8	15,934	4.6	2.3	No Cost/Low Cost	1986
Replace the Mercury Vapor Lamps in Parking Lot with High Pressure Sodium Lamps	50,084	3,078.6	15,695	3.7	2.9	No Cost/Low Cost	1986
Reduce Outside Air Loads	212,410	4,225.4	23,716	1.6	8.1	ECIP	1989
TOTALS	836,550	64,700.4	360,174	5.7	2.3	N/A	N/A

ANNUAL EUI TRENDS

PLAN II

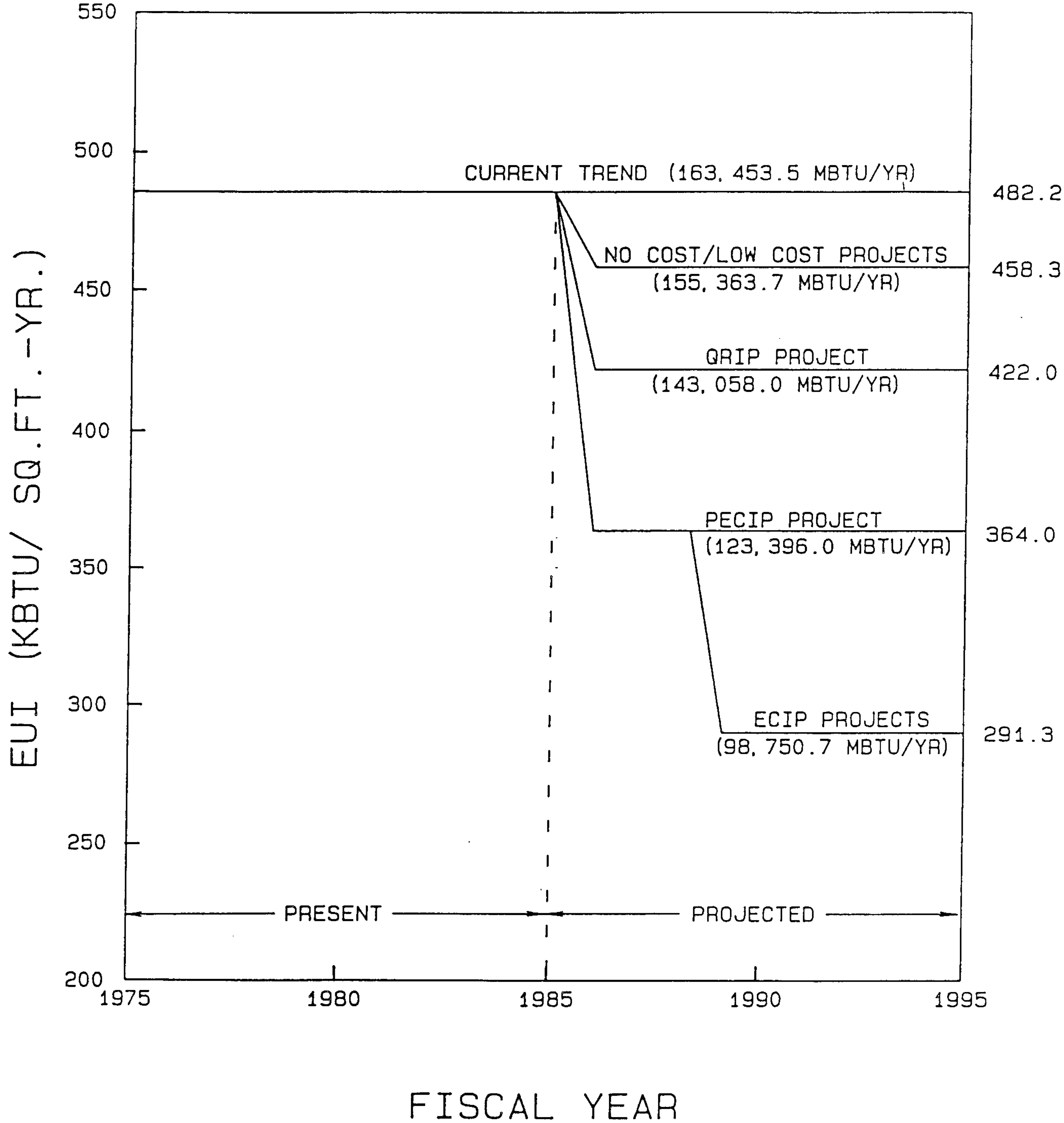


FIGURE 7.2.2

APPENDIX A: GLOSSARY

APPENDIX A: GLOSSARY

1. A: Area (Ft^2)

2. ASHRAE: American Society of Heating, Refrigerating, and Air Conditioning Engineers

3. BOILER HP: Boiler Horsepower - Equivalent to 33440 Btu/Hr or 34.5 Lbs of steam.

4. BTU: British Thermal Unit - Amount of heat energy required to raise the temperature of one pound of water one degree F.

5. CFM: Cubic Feet per Minute

6. C.O.P.: Coefficient Of Performance - Ratio of the rate of heat removal to the rate of energy input, in consistent units, for a refrigerating plant, air conditioner, or heat pump under designated operating conditions.

$$\text{C.O.P.} = \frac{\text{Heat Removed (Btu/Hr)}}{\text{Work In (Btu/Hr)}}$$

7. DEGREE DAY: A unit based on temperature difference and time, used in estimating fuel consumption and specifying nominal heating or cooling load of building. To determine Heating Degree Days (HDD) for any given day, when the mean temperature is less than 65°F, there are as many HDD's as degree fahrenheit difference in temperature between that day's mean temperature and 65°F.

8. DIESEL FUEL NO. 2: A distillate oil used for general purpose heating. Same as DF-2, Diesel Fuel, Fuel Oil No. 2.

9. DF-2: Diesel Fuel Oil No. 2

10. DHW: Domestic Hot Water

11. DTM: Data Transmission Media

12. ECIP: Energy Conservation Investment Program

13. ECM's: Energy Conservation Measures - steps or modifications applied building envelopes or mechanical system to rectify inefficient design and/or operational procedures.

14. E.E.R.: Energy Efficient Ratio - the ratio of net cooling capacity in Btu/Hr to total rate of electrical energy input in watts under designated operating conditions. Similar to coefficient of performance (see C.O.P.).

15. EMCS: Energy Management Control Systems

16. E.U.I.: Energy Utilization Index - a measure of the annual energy consumption in KBtu/Ft²-Yr of any structure, building component, equipment, etc.; and used to define the energy performance of these elements and changes in this due to any given modification.

17. FID: Field Interface Device.

18. °F: Degree Fahrenheit (also Degree F and DEG F)

19. °F Day: Degree Day

20. FPS: Feet Per Second

21. FT: Foot or Feet

22. Ft^2: Square foot or feet (also Sq. Ft.)

23. FTHD: Feet of Hydraulic Column - a measure of the pressure termed in the height of a column of fluid, usually water which it would support.

24. FUEL OIL NO. 2: Diesel Fuel, Diesel Fuel No. 2, DF-2

25. FY: Fiscal Year

26. GAL: Gallon

27. GPD: Gallons Per Day (also Gal/Day)

28. GPH: Gallons Per Hour

29. GPM: Gallons Per Minute

30. GPY: Gallons Per Year (also Gal/Yr)

31. HD: Head - a measure of pressure termed in the height of a column of fluid. (See FT. HD.)

32. HDD: Heating Degree Days

33. HP: Horsepower - a unit of power equipment to 550 Ft.-Lb./Sec. or 2545 Btu/Hr.

34. HR: Hour

35. HVAC: Heating, Ventilating, and Air Conditioning - usually refers to equipment or system type.

36. HTHW: High Temperature Hot Water

37. I.D.: Inside Diameter

GLOSSARY (Continued)

38. IN H_2O: Inches of Water Column - A measure of pressure termed in the height of a column of fluid (see FT. HD.).

39. IN Hg: Inches of Mercury Column (see IN H_2O).

40. IMUX: Intelligent Multiplexer

41. KBTU: One thousand (10^3) Btu

42. KV: Kilovolt or one thousand volts

43. KVA: Kilovolt Ampere

44. KW: Kilowatt or one thousand watts

45. KWH: Kilowatt Hour - Unit of energy equal to that expended by one kilowatt in one hour (equals 3413 Btu Site Energy; 11,600 Btu Source Energy).

46. LB: Pound

47. LF: Linear Feet/Foot

48. MBTU: One million (10^6) Btu

49. MUX: Multiplexer

50. MWH: Megawatt · Hour - one million (10^6) watts per hour.

51. O.D.: Outside Diameter

52. P: Pressure

53. PSF: Pounds Per Square Foot

54. PSI: Pounds Per Square Inch

55. PSIA: PSI Absolute

56. PSIG: PSI Gauge

57. RPM: Revolutions Per Minute

58. T: Temperature °F (also Temp.)

59. Therm: A unit of energy equal to one hundred thousand (10^5) Btu.

60. TLF: Total Linear Feet

61. T-STAT: Thermostat

GLOSSARY (Continued)

62. U-Value: A coefficient expressing the thermal transmittance of a building element expressed in Btu per square foot-hour-°F temperature difference. The reciprocal of R-Value.

63. VFD: Variable Frequency Drive

64. Watt: A unit of energy equal to 3.413 Btu/Hr Site Energy (11.6 Btu/Hr Source Energy)

65. WHR: Watt · Hour

66. YR: Year

67. c_p: Specific heat at constant pressure (Btu/Lb-°F)

68. db: Dry Bulb (also DB)

69. h: Enthalpy - total heat content of a given mass of a substance (Btu/Lb).

70. k: Thermal conductivity (Btu/Hr-Ft-°F)

71. m: Mass Flow Rate

72. q: Time rate of heat flow (Btu/Hr)

73. wb: Wet Bulb (also WB)

74. Δ: (Delta) difference between values

APPENDIX B:

REFERENCES

APPENDIX B:

REFERENCES

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4. ETL 1110-3-335, General Planning/Design Criteria Standards for Medical Facilities dated 22 November 1982.

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APPENDIX C:

SCOPE OF WORK

1 November 1982

Revised 20 May 1983

HNDED-PM/ME

Revised 25 August 1983

Revised 13 October 1983

Revised 28 December 1983

GENERAL

SCOPE OF WORK

ENERGY AUDITS OF ARMY HOSPITALS

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

SCOPE OF WORK
ENERGY AUDITS OF ARMY HOSPITALS
ENERGY ENGINEERING ANALYSIS PROGRAM

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1. DESCRIPTION OF WORK: The Architect-Engineer (A-E) shall:

1.1 Perform a complete energy Audit and Analysis of the entire hospital facility.

1.2 Develop a metering plan for the facility.

1.3 Identify all Energy Conservation Opportunities (ECO) and perform complete evaluations, including low cost/no cost items.

1.4 Install metering system and provide a monitoring program (optional).

1.5 Prepare project documentation for Military Construction Projects (DD Form 1391) and Project Development Brochure (PDB).

1.6 Prepare implementation documentation for all justifiable energy conservation opportunities.

1.7 List and prioritize all recommended energy conservation projects.

1.8 Prepare a comprehensive report which will document the work accomplished, the results, and the recommendations.

2. GENERAL

2.1 A coordinated energy study, including a detailed energy audit, shall be accomplished for the entire hospital facility. The study shall integrate the results of all prior or on-going energy conservation studies, projects designs, or plans which have previously been accomplished, with work done under this contract. It is not intended to prescribe the details in which the studies are to be conducted or limit the A-E in the exercise of his professional engineering expertise, good judgement or investigative ingenuity, however, the information and analysis outlined herein are considered to be minimal essentials for adequate performance of the study. The study shall include a comprehensive energy report documenting study methods and results.

2.2 All ECOs recommended shall comply with all current criteria for medical facilities. This criteria has changed significantly since the hospitals were constructed. In many cases the current criteria will allow reductions in outside air quantities, ventilation rates, and similar items, resulting in significant energy savings.

2.3 All recommended ECOs, including maintenance, operational and low cost/no cost revisions as well as ECIP projects shall be ranked in order of highest to lowest Savings Investment Ratio (SIR).

2.4 If an Energy Engineering Analysis Program (EEAP) study has been accomplished for the installation containing the hospital, the portions of the study applicable to the hospital shall be incorporated into the audit report. The audit report shall list the recommended ECOs from the previous study. This

list shall identify the previous study, summarize the ECOs and the anticipated energy savings, and identify the fiscal year for which the project was or is programmed. The back-up calculations and project documentation from the previous study shall be reproduced and included as an appendix to the report. Any ECO identified in previous studies but not recommended shall be reevaluated under this contract.

3. GENERAL SCOPE OF WORK

3.1 Audit. The audit consists of gathering data and inspecting facilities in the field. These activities shall be closely coordinated with the Contracting Officer, Facilities Engineer Representatives and the Hospital Commander. The A-E shall become thoroughly familiar with each hospital facility and undertake all necessary field trips to obtain required data. The A-E shall document his field surveys on forms developed for the survey, or standard forms, and submit the completed forms as part of the report. Data sources shall be identified and assumptions clearly stated and justified.

3.1.1 Boiler plants, chilled water plants, kitchens, incinerators and similar facilities listed in Annex D that are associated with the hospitals shall be included in the study. They shall be studied to determine the condition of existing equipment, efficiency of boiler plant equipment, operational procedures, adequacy of plant capacity, and heat recovery possibilities in addition to the general items listed.

3.1.2 During the audit process, promising applications of solar energy shall be identified. A short discussion of these applications shall be included in the report with recommendations for a detailed study. Quantitative analysis is not required. Solar applications will result from routine audit actitivies.

3.1.3 Data collected during the audit shall be in sufficient detail to identify each air handling system and zone, areas served, supply, return and exhause air quantities, temperatures and relative humidities, lighting levels and similar data. Room/area and system air quantities, temperatures etc., shall be based on measurements made during the audit and not on "as-built" drawings. It is anticipated that a large portion of the energy savings will result from correctly balancing the air systems and incorporating current air quantity and temperature/humidity criteria. Data collected during the audit shall, as a minimum, include:

3.1.3.1 Building data

a. Building number, building age, number of floors, and gross square feet

b. Floor area, HVAC zones, non-conditioned spaces. usage of space

c. Glass areas

d. Wall and roof surface areas, type of construction, "U" factors

e. Drawings, equipment schedules, distribution layouts, control diagrams, electrical drawings, lighting layout, fixture types, and lighting levels of major systems and areas.

f. Opportunities for maintenance improvements

g. Nameplate data of energy related equipment and condition of equipment

h. An assessment of air flow rates, outside air, exhause rates, water, and other energy media quantities, by room, zone of area as appropriate.

3.1.3.2 Weather information

3.1.3.3 Operating methods

a. Facilities operating hours

b. System and equipment operating and control schedules

c. Control set points, chilled water temperatures, and freeze protection temperatures.

d. Rooms, areas, or zones with special or critical requirements

3.1.3.4 Past performance records

a. Energy peak demands

b. Energy consumption (Gross BTU/yr and BTU/SF/yr).

c. Utility rate schedules

3.1.3.5 Energy sources

3.2 Analysis. The energy analysis is a comprehensive study of the facilities energy usage. It includes a detailed investigation of the facilities operation, its environment and its equipment. The analysis shall use computer modeling. Computer modeling shall be used to incorporate field survey data, weather data, occupancy schedules, building construction data, energy distribution systems and equipment data into a model of the total facility. The computer program shall be used to develop load profiles, calculate energy savings, and evaluate energy conservation measures. The computer program shall be capable of analyzing the energy requirements of buildings; performance of heating, cooling and ventilating equipment; energy distribution systems; and energy conversion equipment. The computer results should be verified by comparing them to any available past utility bills or records. Unless the Building Loads Analysis

and Systems Thermodynamic (BLAST) program is used, the A-E shall submit a sample computer run with an explanation of all input and output data and a summary of program methodology and energy evaluation capabilities for approval by the Contracting Officer prior to use of the program for analysis.

3.2.1 The energy analysis shall provide the following types of information:

a. A theoretical baseline of energy usage of the existing facility

b. Peak energy demand

c. Average energy consumption

d. Comparison of equipment capacities with expected requirements

e. Energy usage by systems

f. Basis for evaluating ECOs

g. A theoretical baseline of energy usage of the facility after incorporation of all recommended ECOS.

3.2.2 The A-E shall develop graphic presentations, i.e., graphs and charts which depict a complete energy consumption picture for the hospital facilities both presently and after implementation of energy saving recommendations.

3.2.3 The A-E shall develop a listing of each room, zone, or area of the hospital as appropriate. The list shall include the air handling system serving the area, the supply, return and exhaust air quantities, temperature and humidity setpoints, lighting levels and similar data. The current criteria requirements for supply, return and exhaust air quantities, temperature and humidity setpoints, lighting levels, etc., shall also be shown. The listing shall be in sufficient detail so that areas with potential energy savings from air balancing, incorporation of current criteria, control revisions and similar measures can be identified.

3.2.4 If data is available, the A-E shall develop an historical load profile by year for the past three fiscal years for each energy source procured.

3.2.5 The A-E shall project energy costs for three fiscal years from date of contract award. (Cost and rates from DEH contract branch shall be used.)

3.3 Project Development. All methods of energy conservation which are reasonable and practical shall be considered, including operational methods, procedures and maintenance practices as well as physical facilities. A checklist of energy conservation opportunities is included as Annex A to this scope. Each of the items shall be considered and discussed in the report. Those items on the list which are not practical, have been previously accomplished, are

inappropriate or can be eliminated from detailed analysis based on preliminary analysis and familiarity with the hospital and its operation shall be listed along with the reason for elimination from further analysis. The list is not intended to limit or guide the AE but only to assure that these published opportunities are considered in the report. All other ECOs identified by the audit or by previous studies that are not subjected to detailed analysis shall be included in the report as discussed above for those items listed in Annex A. All potential ECOs which are not eliminated by preliminary considerations shall be thoroughly documented and evaluated as to technical and economic feasibility.

3.3.1 The A-E shall be familiar with latest Army hospital criteria and evaluate installed systems for possible energy saving revisions which may be permitted by current criteria.

3.3.2 The "Energy Conservation Investment Program (ECIP) Guidance," 10 August 1982 and revised 18 January 1983, establishes criteria for ECIP Projects and shall be used for performing the economic analyses of all ECOs and projects. Construction cost escalation for DD Form 1391 submission shall be calculated using Table 4 of AR 415-17. Additional guidance is contained in the latest applicable edition of the Engineering Improvement Recommendation System (EIRS) bulletin.

3.3.3 Energy conservation measures determined to be technically and economically feasible shall be developed into projects. This will involve combining similar ECOs into larger packages which will qualify for ECIP or MCA funding, and determining, in coordination with installation personnel, the appropriate packaging and implementation approach for all feasible ECOs.

3.3.4 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by SIR.

3.3.5 All energy saving recommendations including ECIP, MCA, and those to be implemented by the installation shall be listed and prioritized by SIR.

3.4 Energy Monitoring and Control Systems (EMCS).

3.4.1 The A-E shall determine the feasibility of an EMCS for the hospital electrical, mechanical and utility distribution systems. Boiler and/or chilled water plants, laundries, kitchens, incinerators, and other similar facilities associated with the hospital shall be included. The intent of this study is to determine the basic conceptual architecture of the EMCS to the extent that primary economic calculations can be made to determine feasibility per ECIP criteria. The documentation shall be of sufficient accuracy to insure that future project design calculations will not deviate more than 20 percent from the study results.

3.4.2 The A-E shall perform feasibility evaluations in accordance with guidance in HNDSP80-013-EDME. The standard evaluation forms contained therein shall be a part of the submittal. EMCS analyses and evaluations shall be developed using TM 5-815-2. Any existing basewide EMCS project or any currently

under design or study shall be considered and evaluated for integration. The A-E shall consider connection of the hospital to this basewide system. An independent system for the hospital with some type of communication with the basewide system for monitoring and data gathering shall also be considered. Fire reporting and/or supervised smoke control shall be considered recognizing that special life-safety criteria, such as Underwriters Laboratories and National Fire Protection Association Compliance, not found in most basewide EMCS will be required. The evaluation shall recognize that hospital users may be reluctant to surrender control of their systems to installation operating engineers. EMCS evaluations shall consider but not be limited to the following features:

a. Start/Stop Programs
   - Scheduling
   - Duty cycling
   - Load shedding for electrical demand limiting
   - Lighting control
   - Start/Stop Optimization

b. Ventilation and Recirculation Program
   - Enthalpy economizer
   - Dry bulb economizer
   - Outside air reduction

c. Temperature Reset Programs
   - Space Temperature night setback
   - Hot and cold deck
   - Reheat coil
   - Chilled water
   - Chiller plant optimization
   - Boiler plant optimization

d. Labor Savings/Monitoring

Example: Boiler plant monitoring (EMCS logging of points which at present are manually logged).

3.4.3 The A-E's recommendations for an EMCS shall be in sufficient detail to define the system configuration, the approximate quantity and types of control instruments and sensors, and the data transmission system. The selection of points to be monitored and controlled shall be given priority based upon ECIP criteria. The development of the data transmission system shall follow the procedures stated in ETL 1110-3-318. The control system functions, expected energy reduction, and monetary savings (including the manner in which these savings are to be achieved) shall be explained.

3.4.4 The A-E shall prepare and provide recommendations in narrative form. Input/output (I/O) summary tables shall be prepared and provided for each system selected in accordance with HNDSP80-013-EDME. Cost estimates shall be prepared and provided in accordance with HNDSP83-049-EDME for the mechanical and electrical modifications required to implement the EMCS.

3.4.5 Inoperative controls shall be noted and replacement/repair cost estimated, as described in HNDSP80-013-EDME.

3.4.6 Labor savings/monitoring shall be included, provided the SIR is not affected to the extent of jeopardizing the ECIP requirements.

3.5 Documentation. All energy conservation opportunities (ECOs) the A-E has considered shall be included in one of the following categories:

3.5.1 ECIP Projects. Energy conservation opportunities which meet ECIP criteria or ECOSs which are combined to meet ECIP criteria shall be developed into ECIP projects. A Life Cycle Cost Analysis Summary Sheet shall be developed for each ECO and for the overall project when more than one (1) ECO is combined. The overall project and each discrete part of the project shall have a Savings Investment Ratio (SIR) greater than one (1). The overall project shall have a construction cost estimate greater than $200,000. For all projects meeting the above criteria, complete programming documentation will be required. Programming documentation shall consist of DD Form 1391, Life Cycle Cost Analysis Summary Sheet(s) (with necessary backup data to verify the numbers presented), and a project development brochure (PDB). For projects and ECOs updated or developed from the previous studies, the backup data shall consist of copies of the original calculations and analysis, with new pages updating and revising the original calculations and analysis. In addition, the backup data shall include as much of the following as is available: The increment of work the project or ECO was developed under in the previous study, title(s) of the project(s), the energy to cost (E/C) ratio, the benefit to cost (B/C) ratio, the current working estimate (CWE), and the payback period. This information shall be included as part of the backup data. The purpose of this information is to provide a means to prevent duplication of projects in any future reports.

3.5.1.1 Military Construction Project Data (DD Form 1391). These documents shall be prepared in accordance with AR 415-15 and the supplemental requirements in Annex B. These forms shall be separate from the report. They shall be bound similarly to the report in a manner which will facilitate repeated disassembly and reassembly. A complete DD Form 1391 shall be prepared for each project. The form shall include a statement that the project results from an EEAP study. Documents shall be complete as required prior to submission to higher DA headquarters. These programming documents will require review and signatures by the proper installation and hospital officials. All documents shall be complete except for the required signatures.

3.5.1.2 Project Development Brochures (PDBs). Preparation of PDBs requires the A-E to delineate the functional requirements of the project as related to the specific site. The A-E shall prepare PDBs in accordance with AR 415-20 and TM 5-800-3. Most projects will not require all the forms and checklists included in the TM. Only that information needed for the project shall be included. The PDB-I format described in the TM shall be used for whatever information is needed.

3.5.1.3 Supporting Data. The A-E shall provide all the data needed to support the recommended project. All assumptions shall be clearly stated. Calculations shall be prepared showing how all numbers in the project were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included as needed.

3.5.2 Non-ECIP Projects. Projects which do not meet ECIP criteria, but which have an overall SIR greater than one (1) shall be individually packaged and fully documented. The Life Cycle Cost Analysis Summary Sheets shall be completed through and including line 6 for all projects or ECOs. Each shall be analyzed to determine if they are feasible even if they do not meet ECIP criteria. For projects or ECOs which meet this criteria, the Life Cycle Cost Analysis Summary Sheet, completely filled out, with all the necessary backup data to verify the numbers presented and a complete description of the project, shall be included in the report. Additionally, these projects shall have the necessary documentation prepared, in accordance with the requirements of the installation and hospital personnel, and as specified in the detailed Scope of Work (Appendix D) and below as noted.

a. Low cost/no cost. These are low cost/no cost projects that the Facilities Engineer can perform with his personnel. For these projects the following information shall be provided:

(1) brief description of the reasons for modification

(2) specific instructions for performing the modification

(3) estimated dollar and energy savings per year

(4) estimated manhours and labor and materials costs. Costs shall be calculated for the current calendar year and so marked. Manhours are to be listed by trade. For projects that would repair an existing system so that it will function properly, also include the estimated manhours by trade and labor and material costs necessary to maintain the system in that condition. Some of the simple practical modifications may be developed on a per unit basis. An example of this type of modification would be the repair or replacement of steam traps on an as needed basis. As a rule; however, the A-E should develop complete projects, if at all possible, rather than per unit modifications. Separate sheets for each project showing the above information shall be prepared and included in the report.

b. Other. These are energy conservation opportunities (ECOs) which are not appropriate for any of the funding programs previously described. The documentation required for these projects will be as indicated by the Facilities Engineer.

3.5.3 Non-feasible ECOs. All ECOs which the A-E has considered but which are not feasible, shall be documented in the report with the reasons why they were rejected shown.

3.6 Metering Plan. After completion of the field survey, the A-E shall develop a plan for metering all significant energy sources used by the entire facility and a feasibility study for submetering of various areas of the hospital facility. The period of metering will be approximately one year.

3.6.1 The source energy metering plan shall include:

a. Services to be metered.

b. Types of meters to be used.

c. Design of metering installation, including sketches and specifications.

d. A detailed estimate of the cost to install the metering system.

e. How the metering system will be serviced and how the data will be collected.

f. A detailed estimate of the cost to monitor the metering system.

g. A detailed estimate of the cost to remove the metering system.

3.6.2 The submetering feasibility study shall include:

a. The feasibility of metering energy use of areas in the hospital such as, Administrative Areas, dining and kitchen areas, intensive care units, and operation suites.

b. The extent of facility modification required, types of metering equipment, quantity of equipment, and budget cost estimates.

c. A suggested submetering approach which would be the most cost effective.

d. This study will provide the basis for a detailed design of submetering if implemented.

The metering plan and feasibility study shall be accomplished and submitted as soon as practicable after the field survey to expedite metering of the facility if the plan is implemented. Immediately upon completion, they shall be submitted to the Contracting Officer for review, comment, and approval. A review conference will be scheduled by the Contracting Officer's Representative including A-E, Facility representatives, and other interested parties. Comments will be presented and discussed. A decision will be made at this conference to implement or not to implement the proposed or revised metering plan. Implementation of the metering plan will be an option to this Scope of Work. If the plan is implemented, a change will be negotiated with the A-E.

3.7 Report. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and be indexed. Tabs or dividers shall clearly and distinctly divide sections, subsections, and appendices. The report shall be presented in loose leaf binders allowing easy disassembly and reassembly. The report shall be arranged in the following manner:

- Executive Summary. The executive summary shall be separately bound. See Annex C for minimum requirements for the executive summary.

- Narrative Report. Contains the executive summary and is the main body of the report.

- Appendix. Contains detailed calculations and reference material.

• Separately bound items. Programming documents, sample computer outputs, completed survey forms, and etc.

4. DETAILED SCOPES OF WORK: The General Scope of Work above is intended to apply to contract efforts for all Army hospitals except as modified by the Detailed Scope of Work for each specific installation. The Detailed Scope of Work is contained in Annex D. Should conflicts occur between the General Scope of Work and the Detailed Scope of Work for any facility, the detailed Scope of Work shall govern.

5. PROJECT MANAGEMENT

5.1 Project Manager. The A-E shall designate a Project Manager to serve as a single point of contact and liaison for all work required under the contract. Upon the award of the contract, this individual shall be immediately designated in writing. The A-E's designated Project Manager must be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for complete coordination of work required under this contract. The Contracting Officer will designate a Project Manager to serve as the Government's single point of contact and liaison for all work required under the contract.

5.2 Installation Assistance: A Project Engineer designated by the Commanding Officer at each installation will serve as the point of contact for obtaining available information and assisting in establishing contacts with the proper individuals and organizations as necessary to accomplish the work required under this contract.

5.3 Public Disclosures: The A-E shall make no public announcements or disclosures relative to information contained or developed under this contract, except as authorized by the Contracting Officer.

5.4 Conferences: Periodic meetings will be scheduled whenever requested by the A-E or Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The A-E and/or the appropriate representative(s) shall be required to attend and participate in all conferences pertinent to the work required under this contract as directed by the Contracting Officer.

5.5 Site Visits, Inspections, and Investigations: The A-E, consultants, if applicable, and/or designated representative(s) thereof shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work. All resulting travel costs and expenses incurred shall be included in the lump sum price of the contract.

5.6 Records: The A-E shall be required to maintain and provide upon request a record of all communications with Government representatives relative to this contract in which the A-E and/or the designated representatives(s) participated.

5.6.1 The A-E shall be required to provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the

A-E and/or designated representatives(s) thereof participated. These records shall be dated and shall identify the contract number, and modifications number if applicable, participating personnel, subject discussed and conclusions reached. The A-E shall forward the Contracting Officer, as soon as possible (not to exceed ten (10) calendar days) a reproducible copy of the records.

5.6.2 The A-E shall be required to provide a record of requests for and/or receipt of Government-furnished material, supplies, data, documents information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The A-E shall forward to the Contracting Officer, as soon as possible, (not to exceed ten (10) calendar days), a reproducible copy of the record of receipt.

6. SUBMITTALS, PRESENTATIONS, AND REVIEWS.

6.1 General: The A-E shall give a brief presentation of each of the submittals below to installation, hospital, command, and other government personnel. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A comprehensive review of the report will be conducted on the same day immediately following the presentation. Each comment presented will be discussed and resolved or action items assigned. The A-E shall provide written notification of action on each comment to all reviewing agencies within three weeks after the review meeting. It is anticipated that each presentation and review will require approximately one working day. The presentation and review conferences will be at the installation on date(s) agreeable to the A-E and the Contracting Officer.

6.2 Interim Submittal: An interim report shall be submitted for review after completion of the field survey and sufficient analysis has been accomplished to develop a list of potential ECO's based upon preliminary evaluations. This report shall be a preliminary form of the final report. This report shall indicate the work which has been accomplished to date, contain samples of the field data which were collected, illustrate the methods and justifications of the approaches taken, and contain a plan of the work remaining to complete the study. The A-E shall identify potential projects which meet ECIP criteria. The A-E shall submit the Scope of Work and the Minutes of the Prenegotiation Meeting as an appendix to this submittal.

6.3 Prefinal Submittal: The A-E shall prepare and submit the prefinal submittal when essentially all of the work under this contract is complete, except for final results of the metering program if implemented. The report shall contain conclusions and recommendations, results of the study, and raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The report shall include an order of priority for accomplishing the recommended practices and projects. Programming documents for Military Construction Projects shall be included, and shall be complete and ready for signature. The A-E shall submit the Scope of Work, the Minutes of the Prenegotiation Meeting, and any changes as an appendix to this report.

6.4 Revision of Prefinal Submittal: Any revision or corrections resulting from comments made during the review of the submittal or during the presentation shall be incorporated into the prefinal submittal. These corrections shall be made as soon as possible following the presentation and review conference and shall be issued to all recipients of the documents. These revisions or corrections may be in the form of replacemnt pages, which may be inserted in the prefinal submittal, or complete new volumes. If new volumes are submitted they shall also be in loose leaf binders similar to that submitted for pre-final. Pen and ink changes or errata sheets will not be acceptable. If the metering plan is not implemented, the prefinal submittal and revisions will be the final report. The final submittal (para 6.5 and 6.6) will not be required.

6.5 Final Submittal: The final submittal shall include an evaluation of the metering program, if implemented. The data from the metering program shall be reduced and organized. The A-E shall develop charts and graphs which summarize the data collected. The A-E shall list all energy conservation recommendations that were accomplished during the metering program and shall indicate when they were completed. A narrative section shall describe the metering program, the results obtained, and recommendations and conclusions. The executive summary shall be revised to include a summary of the metering results. The final report shall be a complete package which will replace the prefinal report.

6.6 Revision of Final Submittal: Any revisions or corrections resulting from comments made during the review of the submittal or during the presentation will be incorporated into the final report. These revisions or corrections mav be in the form of replacement pages, which may be inserted in the final submittal or complete volumes. Pen and ink changes or errata sheets will not be acceptable.

7. OPERATION AND MAINTENANCE INSTRUCTION. The A-E shall prepare a one-day instructional course for the mechanical and electrical operation and maintenance personnel to explain possible energy saving potentials due to modified equipment and systems operation. The course will identify operational items noted during the audit, which will affect energy conservation, and will explain the savings possible. This course will be held near the end of the study period at a time agreeable to the A-E and Facility personnel. This course is in addition to the formal review and presentation required.

8. ENTRY AND EXIT INTERVIEWS. The A-E and the Contracting Officer's representative shall conduct entry and exit interviews with the Facilities Engineer and Hospital Commander before starting work at the facility and after completion of the field work. The A-E shall schedule the interviews at least one week prior to the A-E's entry and exit. The entry interviews shall thoroughly describe the intended procedures for the survey. As a minimum, the interview shall cover the following points:

a. Schedules.

b. Names of surveyors.

c. Proposed working hours.

d. Support requirements from Facilities Engineer.

e. Limitations imposed by hospital operations.

The exit interview shall include a thorough briefing describing the work accomplished, problems encountered, probable areas of energy conservation, and any follow-up efforts which may be required.

9. SERVICES AND MATERIALS. All services, supplies, materials (except those specifically enumerated to be furnished by the Government), plant, labor, superintendence and travel necessary to perform the work and render the data required under this contract shall be included in the lump sum price of the contract.

10. PERIOD OF SERVICE. Expeditious completion of this contract is essential to the accomplishment of the energy conservation goals. Milestone dates, or time allowed for each submittal based on a given number of calendar days, are included in the Detailed Scopes of Work for each hospital facility.

11. SCHEDULING AND REPORTING PROGRESS. The A-E shall prepare and submit an activity diagram or schedule which indicates individual activities, significant events, and milestones along with the scheduled dates for each. The schedule shall cover the entire Scope of Work period of the contract. In addition, the A-E shall submit monthly reports of progress. These reports may be in letter or chart form and shall be worded or keyed to indicate progress on the activity diagram.

ANNEX A

ENERGY CONSERVATION OPPORTUNITIES

Heating, Ventilating, and Air Conditioning

1. Shut off air handling units whenever possible.
2. Reduce outside air intake when air must be heated or cooled before use.
3. Reduce volume of air circulated through air handling units.
4. Shut off or reduce speed of room fan coils.
5. Shut off or reduce stairwell heating.
6. Shut off unneeded circulating pumps.
7. Reduce humidification to minimum requirements.
8. Reduce condenser water temperature.
9. Cycle fans and pumps.
10. Reduce pumping flow.
11. Reset thermostats higher during cooling and lower during heating.
12. Repair and maintain steam lines and steam traps.
13. Use damper controls to shut off air to unoccupied areas.
14. Reset hot and cold deck temperatures based on areas with greatest need.
15. Raise chilled water temperature.
16. Shed loads during peak electrical use periods.
17. Use outside air for free cooling whenever possible.
18. Reduce reheating of cooled air.
19. Recover heating or cooling with energy recovery units.
20. Reduce chilled water circulated during light cooling loads.
21. Install minimum sized motor to meet loads.
22. Replace hand valves with automatic controls.
23. Install variable air volume controls
24. Common headering of chillers.

Boiler Plant

1. Reduce steam distribution pressure.
2. Shut off steam to laundry when not in use.
3. Increase boiler efficiency.
4. Repair, replace, or install condensate return system.
5. Insulate boiler and boiler piping.
6. Install economizer.
7. Install air pre-heater.
8. Check boiler water chemistry program
9. Clean boiler tubes
10. Automate blow-down control.
11. Condenser/cooling tower treatment.

Lighting

1. Shut off lights when not needed.
2. Reduce lighting levels.
3. Revise cleaning schedules.
4. Convert to energy efficient systems.

Building Envelope

1. Reduce infiltration by caulking and weatherstripping.
2. Install storm windows or double pane windows.
3. Install roof insulation.
4. Install loading dock seals.
5. Install vestibules on entrances.
6. Reduce window heat gain by solar shading, screening, curtains or blinds.

Electrical Equipment

1. Shut off elevators whenever possible.
2. Shut off pneumatic tube system whenever possible.
3. Install capacitors or synchornous motors to increase power factor.
4. Shed or cycle electrical loads to reduce peak demand.
5. Balance loads.
6. Reduce transformer losses by proper loading and balancing.
7. Convert to energy efficient motors.

Plumbing

1. Reduce domestic hot water temperature.
2. Repair and maintain hot water and steam piping insulation.
3. Install flow restrictors.
4. Install faucets which automatically shut off water flow.
5. Decentralize hot water heating.
6. Add pipe insulation.

Laundry

1. Install heat reclamation system for laundry wash water.
2. Install heat reclamation system on dryers.
3. Install heat reclamation system on irons.
4. Install thermal fluid heated equipment.

Kitchen

1. Shut off range hood exhaust whenever possible.
2. Install high-efficiency steam control valves.
3. Shut off equipment and appliances whenever possible.
4. Install makeup air supply for exhaust.
5. Install heat reclamation system for exhaust heat.

Miscellaneous

1. Install incinerator and heat recovery system.
2. Install computerized energy monitoring and control system.

ANNEX B

SURVEY & SUPPLEMENTAL DATA & REPORT REQUIREMENTS

To facilitate ECIP project approval, the following supplemental data shall be provided:

a. In title block clearly identify projects as "ECIP".

b. Complete description of each item of work to be accomplished including quantity, square footage, etc.

c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).

d. List references, assumptions and provide calculations to support dollar and energy savings, and indicate any added costs.

(1) If a specific building, zone, or area is used for sample calculations; identify building, zone or area, category, orientation, square footage floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Provide and justify inside temperature profiles before and after retrofit. Include source of expertise and demonstrate savings claimed by work sample techniques. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.

f. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures is not considered an ECIP type project.

g. An ECIP Economic Analysis Summary as shown in the ECIP Guidance shall be provided for the complete project and for each type of retrofit action included in the project. The SIR is applicable to all segments (the whole project and each segment) of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

h. The data package shall include, for the complete project, the annual dollar and MBTU savings, SIR, and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

i. The calendar year in which the cost were calculated shall be clearly shown on the DD Form 1391.

ANNEX C

EXECUTIVE SUMMARY

1. Introduction.

2. Present Energy Consumption.

   - Total Annual Energy Used.

   - Source energy consumption

Electricity	KWH, Dollars	BTU
Fuel Oil	GALS, Dollars	BTU
Natural Gas	THERMS, Dollars	BTU
Propane	GAS, Dollars	BTU
Other	QTY, Dollars	BTU

   - Breakout of Energy Consumption.

3. Historical Energy Consumption.

4. Energy Conservation Analysis

   - ECOS Investigated.

   - ECOS Recommended.

   - ECIP Projects Developed.

   - Other Energy Conservation Projects.

   - Operational or Policy Change Recommendations.

5. Energy and Cost Savings.

   - Total Potential Energy Savings.

   - Percentage of Energy Conserved.

   - Projected Energy and Cost With and Without Energy Conservation Measures.

6. Energy Plan.

- Project Breakouts with Total Cost and SIR.
- Schedule of Energy Conservation Projects.

Include the following data from the Life Cycle Cost Analysis Sheet. The current working estimate (CWE), which is the construction cost plus the SIOH, the energy savings (type and amount), dollar savings and the analysis data. For all programmed projects also include the year in which it is programmed and the programmed year cost.

ANNEX D

DETAILED SCOPE OF WORK

Silas B. Hayes Army Hospital
Fort Ord, California

1. PROJECT DATA:

1.1 Subject: Energy Engineering Analysis Program (EEAP)

1.2 Installation and Location: Fort Ord, California

1.3 Study Title: Energy Audits/Energy Engineering Analysis for Silas B Hayes Army Hospital. Fort Ord, California.

2. GENERAL:

2.1 This detailed Scope of Work applies specifically to the Energy Engineering Analysis Program for Silas B. Hayes Army Hospital. It is intended to supplement the General Scope of Work (GSOW) which was prepared for all Army hospitals. Should conflicts occur between the General Scope of Work and the Detailed Scope of Work, the Detailed Scope of Work shall govern.

2.2 The A-E shall, in consultation with the hospital staff and DEH, establish a facility access/visiting schedule for inspecting, collecting data and interviewing of hospital personnel/staff. The schedule shall list the date, time and duration, area(s) to be visited and a point of contact. The schedule is intended to provide for the coordination of A-E activities with the hospital staff and operation.

3. RELATED PROJECTS AND/OR STUDIES:

3.1 The following is a tabulation of existing energy and related studies and projects at Silas B. Hayes Army Hospital. The current status of each project is indicated. As stated in the General Scope of Work, the A-E is to give proper consideration to all previous studies and projects and incorporate them into the analysis.

	PROJECT	STATUS
a.	Control Systems Alterations (EMCS)	Construction Completed
b.	Installation of CAT Scanners	Programmed
c.	Rehab HVAC Distribution Systems	Programmed
d.	Elevator Repair & Mod	Under Construction
e.	New Medical Clinic	Under Construction
f.	Basewide Energy System Plan (Study)	Completed
g.	Bulk Sterilizer Replacement	Design Completed
h.	Replace Cooling Tower	Design Completed
i.	Install A/C Unit, Nuclear Medicine	Design Completed
j.	Install Standby Heat Exchanger	Under Design
k.	OSHA Corrections	Under Construction
l.	Revamp Fire Alarm System	Programmed
m.	Repair/Replace Freezers & Refrig	Designed
n.	Incinerator/Autoclave	Designed
o.	CMS Vent System	Designed
p.	Consolidation of MICU, SICU, CCU Rec Rm	Programmed
q.	Computer Output Record	Programmed
r.	FSP Tray Conveyor	Designed
s.	Construct Medical Maint. Facility (Adjacent facility)	Programmed
t.	Construct Family Practice Clinic (Adjacent facility)	Programmed
u.	Medical Warehouse (Separate Facility)	Programmed
v.	Consolidated TMC (Separate Facility)	Under Design

w. Vet Facility (Separate Facility) Programmed

x. Redecoration (3rd - 8th Floor) Under Design

3.2 Documents relating to all of the above projects are available either through the project manager or the installation facilities engineer. The above list may be expanded and updated by DEH or USAMEDAC during the study.

4. EMCS: Currently, the existing EMCS has no control function and only monitors the conditions (status) of the Hospital's HVAC and equipment. Thus, the A-E shall determine the feasibility of:

a. Expanding the existing EMCS to monitor and control all mechanical and electrical systems at the hospital with control function located at the hospital only.

b. Providing a completely independent EMCS for the hospital to monitor and control all mechanical and electrical systems in the hospital with remote monitoring at the installation's EMCS location. The above EMCS analyses shall allow for future expansion for hospital security and life safety.

5. DOCUMENT AND DOCUMENTATION:

a. Programming documents (1391 with eighteen (18) paragraph justification and PDB-1) shall be prepared for all feasible ECIP and MCA projects. PDB-2 is not required.

b. Documents and documentation for Non-ECIP and Non-MCA Projects (feasible projects or ECO's which do not qualify for ECIP or MCA funding) shall be prepared, in addition to the requirements of paragraph 3.5.1.c of the GSOW, in accordance with AR 5-4 and the requirements the DEH Comptroller for one of the following categories.

(1) Quick Return on Investment Program (QRIP). This program is for projects which have a total cost not over $100,000 and will amortize in two (2) years or less.

(2) ODS Productivity Investment Funding (OSD PIF). This program is for projects having a total cost greater than $100,000 and an amorization period of less than four (4) years.

(3) Productivity Enhancing Capital Investment Program (PECIP). This program is for projects having a total cost of more than $3,000 and an amortization period of less than four (4) years.

Before starting document preparation the A-E shall consult with Dexter Young, DEH Energy Coordinator, for instructions as to which form (DA Form 5108-R or 4283) is required for each of the above programs.

c. The following itemized list of Government furnished documents are available to the A-E upon request.

(1) Building Information Schedule (Manual)

(2) Utility Procurement Records (including reimbursable)

(3) Basewide Energy Systems Plan, Fort Ord/Presidio of Monterey, Final Report dated July 1982, Proposed by ACUREX Corporation

(4) Army Facilities Energy Plan, Fort Ord, California

(5) Energy Conservation Program (ECIP) Guidance

(6) Economic Analysis Handbook (DESCOM Handbook 11-28. 1-79)

(7) DOD Construction Criteria Manual 4270.1-M (1983)

(8) As-built Construction Drawings for the existing Fort Ord EMCS

(9) TM 5-785, TM 5-800-3, TM 5-815-2, TM 5-838-2

(10) AR 5-4. 415-15. 415-20. 415-17

(11) DA Forms 4283 and 5108-R

(12) ETL's 1110-3-291, 299, 318, 326, 327, 333, 335 & 341

(13) Engineers Improvement Recommendation System (EIRS) Bulletin

6. AUDIT: An energy audit shall be conducted for the Fort Ord Silas B. Hayes Army Community Hospital. The Audit for the hospital facility shall be done in accordance with Paragraph 3.1 of the GSOW, except name plate data will be required only for major energy using equipment for HVAC systems, Electrical System and Medical System. Energy audit is not required for Medical or Dental Clinics.

7. ENERGY SURVEY: An energy survey for the Fort Ord Dental Clinics, Bldgs 3599 and 3700 and Presidio of Monterey Medical-Dental Clinic, Bldg 422 shall be conducted. The survey shall consist of a visual inspection (a walk thru energy audit) of above facilities to identify possible ECO's. Promising ECO's shall be briefly described and included with the hospital pre-interim report. This survey is intended to identify likely energy reduction projects.

8. ENERGY ANALYSIS: An energy analysis shall be made for the Silas B. Hayes Community Army Hospital. The analysis shall be performed in accordance with paragraph 3.2 of GSOW. Energy analyses are not required for the Fort Ord and Presidio of Monterey Dental Clinics. The A-E will use DOE 2.1A computer program for energy analysis and modeling. Since this program has been used before on the EEAP studies, sample run will not be required.

9. Project Packaging: The A-E shall work closely with the DEH and Hospital Representative in determining which feasible energy conservation measures may be combined into an ECIP or MCA project.

10. Operation and Maintenance Instruction: Since the boilers (and related equipment) and HVAC systems are maintained and operated by different personnel groups, two (2) days of Operation and Maintenance instructions shall be provided. One day of instruction shall be on the boilers associated equipment/ controls, and one day of instruction shall be given on the operation and maintenance of the HVAC systems and all other mechanical and electrical systems. They shall consult with the DEH energy coordinator to ensure that the instructions focus on DEH needs. The A-E is encouraged to consult with PG & E energy office (Mr. Ted Ross, Salinas, CA, (408) 757-0661) to determine what training and metering services PG & E will offer that may be used under this study.

11. Option 1: For the purpose of negotiating this contract, the basic work consists of the energy audit and energy engineering analysis as defined by the GSOW and DSOW. Under Option 1 the A-E shall prepare additional (to basic work) programming documents (1391's) as requested for feasible projects for S. B. Hayes Hospital, Fort Ord Dental Clinics (Bldgs 3599 and 3700) and the Presidio of Monterey Medical/Dental Clinic (Bldg 422).

12. Submittals and Period of Service: The Energy Audits and Energy Engineering Analysis Program submittals for the hospital and the Energy Survey for awarded opitions shall conform with the requirements of Paragraphs 6 of the General Scope of Work. Submittals shall be submitted as follows:

a. Pre-Interim: The A-E shall submit, upon completion of the hospital survey and review/evaluation of relative studies and projects (current and planned), a list and description of all potential ECO projects (including those identified during the survey of the clinics) intended for consideration under this study. The purpose of this submittal is to permit the DEH and hospital staff to coordinate and screen ECO projects to be analysed in this study. Twenty (20) copies shall be provided for review, screening and selection. Submittal is due sixty (60) calendar days after receipt of notice to proceed.

b. Interim: The submittal for the hospital facility shall conform with the requirements of Paragraph 6.2 of GSOW. This submittal is a draft final report of the Audit and Engineering Analysis with incorporation of comments from the Pre-Interim report review. Submittal is due ninety (90) calendar days after the receipt of review comments to proceed. Twenty (20) copies of the submittal shall be provided for review.

c. Pre-final: The submittal for the hospital facility shall conform with the requirements specified in Paragraph 6.3 of the GSOW. Submittal is due sixth (60) calendar days after the receipt of the Interim review comments. Twenty (20) copies of this submittal is required.

d. Final: The final (corrected pre-final) will conform with requirements of Paragraph 6.4 of the GSOW. The final submittal is due forty-five (45) calendar days after the receipt of pre-final review comments.

e. Additional advanced planning documents (Option 1) - Concurrent with pre-final submittal.

13. Measurement and Payment

13.1 All costs associated with the energy audits and energy analyses, including gathering data, field inspection, compiling and analyzing data, preparing study reports, computer modeling, attending conferences, developing energy plan, etc. will be negotiated as one lump sum price for Silas B. Hayes Army Community Hospital Energy Audit and Energy Engineering Analysis Program.

13.2 Payment for costs associated with the preparation of programming documents (1391's and PDB's) for each feasible project shall be based on a unit price for each set of documents. For the purpose of negotiation, the A-E shall assume preparation of three (3) sets of programming documents under this basic contract.

14. Points of Contact:

14.1	Sacramento District:	Nathaniel Hunter, Project Manager Installation Support Section	(916) 440-3507
14.2	Fort Ord;	Dexter Young, Directorate of Facilities Engineering, Energy Coordinator	(408) 242-6494
14.3	Fort Ord:	Col. Tello, USAMEDDAC Chief, Logistic Division	(908) 247-5198

SPKED-M

11 October 1983
NH/CM
Revised 13 October 1983

SOW CONFERENCE

SUBJECT: Energy Audits/Engineering Analysis Program Study, Silas B. Hayes Army Community Hospital, Fort Ord, California.

1. A Scope of Work (SOW) review and clarification conference was held in Room 222 of subject hospital. The conference was attended by representatives of the Hospital and DEH Staff, Chilton Engineering (A-E) and Corps of Engineering, Sacramento District - See attendee list, enclosure 1. Issues and actions handled during the conference are summarized below:

2. General Scope of Work (GSOW): The GSOW was reviewed by reading through almost every paragraph. Most paragraphs were accepted and retained as written. Paragraphs noted below were discussed for clarification or modification.

a. Paragraph 2.4: Paragraph to remain intact, but the DEH will provide the A-E with a copy of all available design concepts and studies for programmed hospital projects on or before the Prenegotiation Conference of 21 October 1983. The documents will be listed in the Detailed Scope of Work (DSOW). The Basewide Energy Systems Plan, Fort Ord/Presidio of Monterey Final Report has been given to the A-E for his review. A-E will send letter request to DEH for past studies and data covering Hospital Projects (past and future).

b. Paragraph 3.1.1: No revisions of paragraph; but minutes will reflect the hospital does not have in operation currently an on-site incinerator. A remote incinerator in Bldg. 1442 had been used for sterilization of hospital apparatus The remote incinerator has become inoperative and will be replaced by a remote sterilizer (to be relocated in Bldg. 1442 also). The DSOW will cite if the A-E will include the remote incinerator in this study.

c. Paragraph 3.1.3: No revisions of paragraph; but the minutes will show (and will be covered in the DSOW) that the A-E will not be required to collect data (make measurements) from every room if zone data or sample information (measurement) will provide necessary data.

d. Paragraphs 3.1.3.1; and 3.2.3: No revisions of paragraph: the DSOW will specify generally the equipment for which the A-E shall obtain name plate data. The A-E will develop a list of equipment recommended requiring name plate information.

e. Paragraph 3.2: No revisions of paragraph; but the DSOW will indicate the computer system the A-E will use in this study.

f. Paragraph 3.5.1c; After the word "data", line four, insert the following; "and a cost estimate that includes labor cost (manhours and trades) and material cost plus brief description of installation procedures."

3. ANNEX A: The DEH hospital maintenance representative, Dee Letterman, recommendation for deletion of item 4 "use emergency generator to reduce peak demand" under heading "Electrical Equipment" will be done.

4. ANNEX B & C: These Annexes will remain as currently written.

5. ANNEX D (Detailed Scope of Work):

a. In general, this Annex will be revised to incorporate clarification of GSOW and include special requirement covered during the conference.

b. Add new paragraph: "4: EMCS: ~~Studies~~"(see Inclosure 2).

c. Paragraph 2.2: Revised first sentence to read "The A-E shall, upon receipt of notice to proceed, in consultation with the hospital and DEH staff establish a facility access/visiting schedule for inspecting hospital facilities, collecting data and interviewing hospital personnel."

d. Paragraph 4b(10): Change "ARS4-5" to "AR 5-4".

e. Paragraph 4b(12): Revise Paragraph to read "ETL'S 1110-3-291, 299, 318, 326, 327, 332, 333, 335 and 341".

f. Paragraph 5: End of line two, change "to" to "may", on third line; change "to make one" to "into an".

g. Paragraph 7: Options; The Corps of Engineers Project Manager and the A-E will reassess work to be done under Options 2 and 3.

h. Paragraph 8a: Last sentence, change "sixty (60)" to "Ninty (90)".

6. General: The following points of clarification as information will be developed before the Prenegotiation Conference.

a. Identification of POC for life safety requirements and determination if life safety should be included in the study.

b. POC for hospital security matters will be established at the Pre-negotiation Conference scheduled for 21 October 1983.

c. A-E will send letter of request to the DEH asking that all available relevant hospital project studies, designs, etc., be available at the Prenegotiation Conference.

d. The Project Manager (COE) will confirm if PDB-2's are required as part of the programming documents.

e. The A-E and Project Manager (COE) will assess the energy audit service available from PGE that can be used to supplement the A-E effort for this study. The intent is to use PGE energy audit resources to develop data and provide personnel training wherever possible.

f. A more detailed list of current and planned hospital projects will be provided to the A-E at the Prenegotiation Conference.

g. Cal Tello and his office shall be added to the distribution list: The address is:

Commander, USAMEDDAC,
ATTN: Chief Logistic Division (Cal Tello)
Fort Ord, California 93941

NATHANIEL HUNTER
Project Manager

DISTRIBUTION

A-E:

Mil Proj Br., ISS (Hunter) (Original)

SCOPE OF WORK CONFERENCE

SUBJECT: Energy Audits/Energy Engineering Analysis Program Study, Samual B. Hayes Community Hospital, Fort Ord, CA

ATTENDANCE LIST

NAME	REPRESENTING
Dexter Young	DEH-ERM - Energy
Linda Finley-Miller	DEH-SP&S - Engineering
Dee Letterman	DEH Hospital SYPP, BR.
Elizabeth C. Dinella	Nutr. Care Division
Brad Dungar	HFPO, SGFP
Richard C. Tello	C, Log Div, USAMEDDAC
Nathaniel Hunter	COE, Sacramento District
Allan Giesbrecht	Chilton Engineering
Sheldon Gordon	"
G. S. Robinson	XO, Dental Activity

3.2 EMCS Study ~~Annex~~: Currently, the existing EMCS has no control function and only monitors the conditions (status) of the Hospital's HVAC and equipment. Thus, the A-E shall determine the feasibility of:

a. Expanding the existing EMCS to monitor and control all mechanical and electrical systems at the hospital with control function located at the hospital only.

b. Providing a completely independent EMCS for the hospital to monitor and control all mechanical and electrical systems in the hospital with remote monitor at the installation's EMCS location.

Note: the paragraph as written for the SOW conference of 7 October 1983 - see DSOW for incorporation

N. Hunter

CONFERENCE MINUTES

Subject: Energy Engineering Analysis Program, Silas B. Hayes Army Hospital, Fort Ord, California

1. On 7 October 1983, a Pre-Design Conference for the above subject project was held at the Silas B. Hayes Army Hospital. Representatives from the hospital staff, facility engineering, the Corps of Engineers, and the A-E (Chilton Engineering, Chartered) attended.

2. The General Scope of Work for the above project was read by Nathaniel Hunter, the COE SPKED-M Project Manager. The following discussion/comments were made: SPK

   Para. 3.1: It was decided that the A-E will transmit only sample data collection forms in the submittals due to the large volume of material involved. The A-E will transmit the data forms in their entirety to the Facility Engineering Department. Clome

   P. 3.1.3: The A-E was instructed by the Project Manager to use their engineering judgement in performing the field investigation. In order to minimize disruption of hospital activities, it will not be necessary to inspect duplicate rooms/areas when a representative sample can be inspected. Also, for air flow measurement and testing, the A-E is required only to measure primary air flows at main zone branch points. The measurement of each room diffuser is not required. C

   P. 3.1.3.1: Nameplate data for special diagnostic equipment will be provided by the Medical Maintenance department. C

   P. 3.2: The A-E intends to utilize the DOE 2.1A computer program for building energy analysis. Everyone in attendance agreed to the use of this computer tool. C

   P. 3.4: Since increased security at the hospital is of interest to all concerned, the A-E will identify the opportunity for providing security within the EMCS and will also provide some unit costs associated with accomplishing this. C

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SPK

P. 3.5: It was decided and MCA by all conference attendees that feasible ECIP projects will require only PDB-I's (in addition to DD Form 1391's) for programming documentation. PDB-II's will not be required. C

P. 3.5.1c: A statement will be added to this paragraph requiring that these projects will include estimated manhours by trade, and cost estimates will delineate labor and material costs. C

P. 6.3: It was agreed that the Pre-Final Submittal will be submitted in a 3-ring binder. Revisions or corrections to this document will be in the form of replacement pages/added pages which may be inserted to produce the Final Submittal. This will be true regardless of whether the metering plan is implemented. If the metering plan is implemented, space will be left in the Pre-Final document so that a section containing the results of the metering plan can be easily inserted into the Final Submittal. Reproduction of the entire document for the Final Submittal will not be required. C

P. 7: The A-E may work with PG&E to provide the one day operation and maintenance instruction. C

3. The following discussion/comments were made regarding Annex D, Detailed Scope of Work.

Para. 3.1: Facility representatives stated that the list of related projects/studies should include more items and they will provide documentation on all items applicable. C

P. 7.2 & 7.3: The level of effort required for the "energy audit" of these additional buildings must be defined. The A-E feels that the Scope of Work for these options is vague. If a "reduced" audit effort is required, it must be determined whether this effort is of a "qualitative" or a "quantitative" nature. Also, the schedule for auditing these buildings must be determined. These items must be clarified prior to the A-E's cost proposal on these options. C - See revised DSOW

P. 8b: The period of performance for submission of the Pre-Interim report was changed from 60 days to 90 calendar days after receipt of notice to proceed. C

General: The A-E requested that the Project Manager provide a mailing distribution list for contact personnel at the hospital. Will develop and provide at the Pre-Negotiation conference C